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Arthur D. Little, Inc., Cambridge, MA

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~~Arthur D. Little Characterized~~ facilities, transportation activities, business/administrative practices, regulatory environment, and financial and economic structure of transporters of hazardous waste in the United States. In addition, ~~they assessed~~ the costs of compliance with and economic impact of the EPA-proposed hazardous waste transportation regulations, Section 3003 of the Resource Conservation and Recovery Act (RCRA), were assessed.

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CHARACTERIZATION OF HAZARDOUS WASTE TRANSPORTATION AND ECONOMIC IMPACT ASSESSMENT OF HAZARDOUS WASTE TRANSPORTATION REGULATIONS

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I. EXECUTIVE SUMMARY

A. PURPOSE AND SCOPE

Section 3003 (42 USC 6923) under Subtitle C of the Resource Conservation and Recovery Act of 1976 (RCRA) requires that the Environmental Protection Agency promulgate standards applicable to transporters of hazardous waste as may be necessary to protect human health and the environment. In recognition of the need for the development of Section 3003 standards, it is the purpose of this report to:

- Characterize the facilities, transportation activities, business/administrative practices, regulatory environment, and financial and economic structure of transporters of hazardous waste in the United States; and

- Assess the costs of compliance with and economic impact of EPA-proposed hazardous waste transportation regulations.

Such transportation is normally required to convey hazardous wastes from the generator of these wastes to an off-premises waste facility for treatment, storage, and/or disposal.

This report focuses on aspects of hazardous waste transportation related to the four basic requirements under Section 3003, namely: 1) recordkeeping concerning such hazardous wastes transported, and their source and delivery points; 2) transportation of such wastes only if properly labeled; 3) compliance with the manifest system developed under Section 3002 of the Act; and 4) transportation of all hazardous wastes only to the hazardous waste management facilities which the shipper designates on the manifest form to be a facility holding a permit issued in accordance with Section 3005 of the Act.

B. SUMMARY OF MAJOR FINDINGS

1. Transporter Segments

Although transporters of hazardous waste do not constitute an industry in the usual meaning of the term, three distinct participants or segments have been identified:

- Generator/transporter--generators, including industrial, commercial, and governmental organizations, that act as private carriers and self-haul hazardous wastes, invariably by truck, to off-site hazardous waste management facilities.
- For-hire transporter--common and contract carriers, whose principal business is commodity and/or waste transportation, that transport hazardous waste from the point of generation to off-site hazardous waste management facilities which they do not also operate.
- Hazardous waste management facility/transporter*--operators of hazardous waste management facilities that act as contract or private carriers in transporting hazardous waste from the point of generation to treatment, storage, or disposal facilities.

The vast majority of hazardous waste transport is by motor truck, with rail a distant second. The distribution of hazardous waste transport by mode appears in Table I-1, where it is seen that air and pipeline transport are negligible. This basic information is shown in somewhat more detail in Table I-2. The generator/transporter trucks about 2-3 percent of all hazardous wastes that are transported off-site. It has not been possible in this study to determine separately the amounts of hazardous waste transported by for-hire motor carriers or HWMF/transporters. From Table I-2 it can be seen that both the generator/transporter and HWMF/transporter engage solely in trucking. The focus of attention, then, is on railroad and motor carrier operations of the three segments.

2. Insurance Coverage

Railroads generally carry $25-50 million in third-party property damage with large deductibles ($1-2 million). As a whole, railroads would appear to have sufficient financial resources to meet their

---

*Referred to as HWMF/transporter.

TABLE I-1

ESTIMATED AMOUNT OF HAZARDOUS WASTE TRANSPORTED BY MODE, 1977

Transport Mode	Hazardous Waste Transported (Metric Tons)	Percent of Total Hazardous Waste Transported
Rail	400,000	5
Highway	7,400,000	94
Waterway	100,000	1
Air	Negligible	Negligible
Pipeline	Negligible	Negligible
Total	7,900,000	100

SOURCE: Arthur D. Little, Inc., estimates.

TABLE I-2

ESTIMATED AMOUNT OF HAZARDOUS WASTE TRANSPORTED BY MODE AND SEGMENT, 1977

(Metric Tons)

Transport Mode	Generator/ Transporter	For-Hire Transporter	HWMF/ Transporter	All Segments[a]
Rail (%)	0	400,000 (5)	0	400,000 (5)
Highway (%)	160,000 (2)	?	?	7,400,000 (94)
Waterway (%)	0	100,000 (1)	0	100,000 (1)
Air	0	Negligible	0	Negligible
Pipeline	Negligible	0	Negligible	Negligible
All Modes (%)	160,000 (2)	?	?	7,900,000 (100)

---

[a] Table I-1

SOURCE: Arthur D. Little, Inc., estimates.

responsibilities stemming from spills of hazardous waste. The same is true for the major generators of hazardous wastes that self-haul off-site, as well as for the large national common motor carriers that haul hazardous materials and wastes.

Most states have enacted financial responsibility laws for owners of motor vehicles, although some states require no coverage. Typically, the highly industrialized states require $100,000 in coverage for bodily injury or death of one person, $300,000 for bodily injury or death of more than one person, and $50,000 for property damage to others. A few states have recently made special provision for transporters of hazardous materials. Motor vehicle liability coverage specifically extends to injury and damages attributable to accidental loss of cargo. However, smaller firms transporting hazardous materials and/or wastes and others with blemished safety records, are at a significant disadvantage in obtaining sufficient liability coverage. Insurance companies express great concern about the general problem of providing adequate coverage for spills of hazardous materials and wastes, particularly where cleanup of the environment would be a covered expense. Coverage of hazardous material and hazardous waste spills is currently undergoing change within the insurance industry.

3. Regulatory Control

All transporters engaged in interstate commerce involving hazardous materials are subject to regulations promulgated by the U.S. Department of Transportation. Most hazardous wastes in interstate commerce, but by no means all, accordingly are regulated by the DOT. Because a substantial but unknown portion of hazardous waste is transported intrastate, the operations of these intrastate transporters are governed only by existing state regulations, which vary appreciably from state to state. Although all transporters of hazardous waste contacted in this study claim to abide by existing Federal and state regulations, it was not possible to verify these claims of compliance. Furthermore, no effort was made in this study to examine the enforcement policies and practices of Federal and state authorities. The greatest opportunity for violation of existing regulations applies to motor carriers because of their diverse operations, large number of vehicles in operation, and overall lower visibility, than, say, railroads or airlines.

The transportation of property by carriers engaged in interstate or foreign commerce is subject to regulation by the Interstate Commerce Commission. The Commission has recently ruled to the effect that hazardous waste intended for disposal does not constitute "property" and, therefore, does not come under its jurisdiction. The effect of this ruling would appear essentially to minimize the role of the Commission insofar as ensuring the safe transport of hazardous waste.

4. Costs of Compliance

a. Motor Carrier

The costs of compliance for five truck transporter models are shown in Table I-3. Recordkeeping requirements appear here as a fixed charge per truck, although Model 3 may have slightly lower costs due to fewer trips. Recordkeeping associated with the manifest requirements vary with the number of trips and additional driver time required. Thus the cost per truck is lower for Models 1, 2 and 3, which make two trips per day in their respective transportation scenarios, than for Models 4 and 5 where driver time is required to comply.

Registration cost was estimated at $24 for each hazardous waste transport company during the first year. Marking will also require an expenditure of $24 for each truck in the first year (assuming that trucks are not currently marked). To be conservative a cost of $48 per truck was used for registration and marking combined. The cost of spill cleanup, $1320, was based on an EPA study of all spilled hazardous materials. The per truck spill frequency for hazardous waste transporters is unknown and thus

TABLE I-3

SUMMARY OF COMPLIANCE COSTS WITH RCRA SECTION 3003 FOR TRUCK TRANSPORT

Truck Model	Registration	Recordkeeping	Manifest System	Marking	Total Costs	
					First Year	Recurring
Model 1[a]	$24	$116/year	$ 250/year	$24	$ 414	$ 366
Model 2[b]	24	116/year	250/year	24	414	366
Model 3[c]	24	116/year	125/year	24	289	241
Model 4[d]	24	116/year	1,452/year	24	1,616	1,568
Model 5[e]	24	116/year	1,452/year	24	1,616	1,568

Spill Cleanup: $1,320

SOURCE: Arthur D. Little, Inc., estimates.

[a] Three-axle, power unit tractor; unlined aluminum tank unit (4,500 gal); 190,000 ton-mi./yr; 2 trips/day.

[b] Two-axle, power unit tractor; unlined aluminum tank unit (1,600 gal.); 26,250 ton-mi./yr.; 3 trips/day.

[c] Semi-tank, three-axle power unit trailer; unlined aluminum tank unit (6,000 gal.); 625,000 ton-mi./yr.; 1 trip/day.

[d] Tilt-frame with 40-foot roll-off container (80 55-gal. drums), three axle power unit tractor; 225,000 ton-mi./yr. 2 trips/day.

[e] Straight truck with 20-foot bed (30 55-gal. drums); 50,000 ton-mi./yr.; 2 trips/day.

the cost of spill cleanup is shown separately.

b. Rail Carrier

For rail transport, existing bills of lading can be used to meet manifest system requirements. However, additional recordkeeping might be required and therefore the impact of an additional expense of $116 per car per year and $2.00 per trip was evaluated.

c. Water Carrier

There are no additional compliance activities imposed on water transport as a result of Section 3003 provided that the current shipping papers or dangerous cargo manifests can be used and no additional recordkeeping or reporting requirements are necessary beyond those which currently exist.

d. Other Modes (Air and Pipeline)

The costs of compliance for other modes of transportation are negligible.

5. Economic Impact Assessment

The impact of Section 3003 on transporters of hazardous waste was evaluated both for a set of individual transport vehicles and for composite companies representative of a for-hire transporter and a hazardous waste management facility. The impact on generators was estimated by calculated the total cost impact.

a. Impact on Vehicle Operating Cost

(1) Truck Transport

The increase in operating cost as a consequence of Section 3003, shown in Table I-4, will be greatest for transportation of drummed waste and other waste that the truck operator must manually handle during loading and unloading operations. This is due to the allocation of additional truck driver's time to have the manifest signed. The increase is greater for truck Model 5 than for truck Model 4, because Model 5 has fewer ton-miles per year. Likewise, the impact on truck Model 3 is the least because it represents a high annual mileage, long-trip distance scenario. This is the expected result singe costs of compliance vary with the number of trips.

The cost of spill cleanup used here amounts to 3.2-4.7 percent of annual operating cost, and the total cost of spill cleanup is estimated at $281,000 based upon some 213 spills per year.

(2) Rail Transport

The direct impact of compliance activities is shown in Table I-4, which presents the discounted cost of owning and paying fares for rail cars over twelve years to transport spent sulfuric acid on a high-volume route (Model 2), and a low-volume route (Model 1), and all routes nationally. Leased car and purchased car alternatives are presented. For rail transport the cost of compliance represents a very small increase in operating costs, with a maximum 0.8 percent increase in the twelve-year costs due to compliance.

b. Impact on Companies

Two company financial models, one for a for-hire transporter and one for a waste management facility also engaged in transportation, were analyzed to determine the impact of the cost of compliance with Section 3003. These impacts were then translated into cost impacts on generator industries. Results appear in Table I-5.

(1) For-Hire Transportation Company

In the absence of a price increase, profitability would decline by 9 percent. However, an increase in revenue of 2.6 percent overall is needed to maintain the same rate-of-return. The impact of compliance upon the transportation company, assuming a balanced mixture of vehicle types, is between that for the high-impat and low-impact models.

TABLE I-4

IMPACT OF RCRA SECTION 3003 REGULATIONS UPON OPERATING COSTS

A. TRUCK TRANSPORT

Truck Transport Models	# Trips/Day	Cost of Compliance		Annual Operating Costs	% of Operating Costs		Spill Cleanup	
		First Year	Subsequent Years		First Year	Recurring Years	Cost	% Operating Costs
1	2	$ 414	$ 390	$32,500	1.3%	1.2%	$1,320	4.1%
2	2	414	390	28,375	1.5	1.4	1,320	4.7
3	1	289	215	41,500	0.7	0.6	1,320	3.2
4	2	1,616	1,640	34,000	4.9	4.8	1,320	3.9
5	2	1,616	1,640	29,625	5.6	5.5	1,320	4.5

B. RAIL TRANSPORT

Rail Car	Cost of Lifetime Operation		
	Before Compliance	After Compliance	% Change
Model 1			
Leased Car	$ 84,600	$ 85,000	0.5
Purchased Car	90,000	90,400	0.4
Model 2			
Leased Car	771,300	776,000	0.6
Purchased Car	819,000	824,700	0.6
National Total			
Leased Car	5,545,000	5,590,000	0.8
Purchased Car	5,703,000	5,590,000	0.8

Source: Arthur D. Little, Inc., estimates.

TABLE I-5

REQUIRED INCREASE IN REVENUE TO RECOVER COSTS OF COMPLIANCE WITH RCRA SECTION 3003

	Number of Vehicles	Baseline		Required Increase in Revenue		Impact on Profit With No Price Increase	
		Revenue	% ROC[a]	$	% Change	% ROC[a]	% Change
For-hire Transportation Company	14	$ 670,292	6.7	$17,642	2.6	5.7	-9
Hazardous Waste Management Facility	7	1,635,190	15.4	8,800	0.5	15.0	-3

[a] ROC: Return-on-Capital

Source; Arthur D. Little, Inc., estimates.

There could be a differential impact upon rates that generators pay if the differential cost impact per truck type or trip is reflected in a relatively higher rate increase for short-haul, low-volume drummed waste transport. This again implies that small waste generators will face a greater relative increase than larger waste generators, although the increase for both is not great.

(2) Hazardous Waste Management Company

In addition to the direct costs of owning and operating trucks, hazardous waste management facilities have other expenses and pricing policies which can result in a different impact on rates than that indicated by examining trucks above. An increase in truck expenses can be offset by increases revenues from trucking and/or disposal operations.

The decline in profitability in the absence of a price increase would be 3 percent, and a price increase of 0.5 percent is required to recover the cost of compliance with Section 3003.

(3) Generators

If transportation costs increase by 2.6 percent, the total cost to generators (14 industries identified by the EPA) of transporting hazardous waste will increase between \$0.7 million and \$0.6 million as a consequence of Section 3003. This increase is a fairly insignificant portion of the cost of manufacture or value added.

C. SUMMARY OF DETAILED FINDINGS

1. For-Hire Transport

a. Rail Carrier

- Roughly 5 percent (400,000 metric tons) of hazardous waste in transport moves by rail.
- Most hazardous waste transported by rail moves in tank cars which are owned by generators.

- Most hazardous waste transported by rail is destined for reclamation centers as opposed to disposal facilities.
- Intermodal transfers of hazardous waste involving rail consist of truck pick-up or delivery to rail sidings, barge transfer, or rail-truck piggyback.
- Rail shipment of hazardous waste in large volumes and over long distances is less expensive than by truck, and actual use reflects these economies.
- The dominant regulations pertaining to hazardous waste are those administered by DOT and ICC, and these control handling, loading, acceptance, marking, recordkeeping, and classification of hazardous materials.
- Railroads do not ordinarily load, unload, or otherwise directly handle hazardous waste as such, but only transport rail cars ready for delivery. As common carriers regulated by the ICC, all properly prepared shipments must be accepted for delivery to the consignee.

b. Motor Carrier (Truck)

- Facilities and Services Provided
  - Most firms have only one terminal location.
  - Some firms do have temporary storage facilities, but on-site storage of hazardous wastes is uncommon and uneconomic.
  - For large interstate common carriers, hazardous waste transportation represents only a small portion of their business.
  - Small intrastate carriers may specialize in hazardous waste transportation.
  - About half of the firms contacted transport interstate.
  - All firms contacted are either privately owned or closely-held stock corporations.
  - Nearly 70 percent of the companies had 30 or fewer vehicles; 35 percent had 5 or fewer.

  - Some companies specialize in a particular waste (e.g., waste oil), but most handle a variety.
  - The vast majority of transporters rely on generators for chemical analysis of waste.

- Transportation Activities
  - Excluding national common carriers, the average round trip distance travelled is about 50 miles. The national common carriers typically travel hundreds of miles.
  - The majority of vehicles are tank trucks with a capacity of 1200-8600 gallons.
  - Most vehicles in use are less than 8 years old and have a useful life of 5 to 10 years.
  - Intermodal shipments are uncommon.
  - Contractual arrangements between the transporter and generator allow little time to plan for the routing and dispatching of trucks.
  - Responsibility for loading the vehicles depends upon the form of waste and type of vehicle; if containers are supplied by the generator, it is the generator's responsibility to load. Vacuum trucks are loaded and unloaded by the transporter. Tank trucks are usually fully loaded by a single generator. National common carriers make fewer multiple stops than other transporters.
  - Generally, it has been the transporter's responsibility to select and deal with a disposal site.
  - All large interstate carriers contacted use DOT placards and follow ICC regulations; among the smaller truckers, there are variations in practices having to do with marking, labeling, and placarding.

- Business/Administrative Practices
  - All firms contacted keep shipping records, the most common of which are bills of lading and weigh tickets

most often used for billing purposes, and for reporting to state environmental agencies; the retention period is typically 5 to 7 years.

- Safety practices include driver training, personal protective equipment, and vehicle maintenance.
- Most transport companies bill generators for both transport and disposal; these charges are not always distinct.

c. Water Carrier

- Facilities and Services Provided
  - The only vessels found to carry hazardous wastes are barges (often tank barges).
  - The most commonly used barge is a 3-compartment tank barge with a capacity range of 1200-1500 short tons. These barges are usually double-hulled and some have double bottoms.
  - The total quantity of hazardous waste shipped in the U.S. by barge appears to be relatively small (when compared to truck transport).
  - Barge shipments of hazardous waste move primarily on the Gulf Intracoastal Waterway and the Missouri-Mississippi River System.
  - All contacted companies are privately owned and operate as contract carriers.
  - Hazardous waste transport accounts for only a small portion of their transportation activities.
  - The destination is generally a resource recovery as opposed to disposal facility.
- Transportation Activities
  - Activities include scheduling and routing of barges, mechanical pumping operations for loading and unloading directed by a tankerman, and vessel towing to the destination.

- It is not unusual for a barge to change tows several times during a trip.
- Barge companies communicate regularly with tow boat crews to ascertain position.
- Depending upon the time of arrival, the waste cargo will either be accepted (and transferred) immediately, or the barge may be placed in a queue perhaps for several days.

- Business/Administrative Practices
  - The bill of lading and dangerous cargo manifest are the commonly used shipping documents. In most cases, the manifest remains on board unmanned barges carrying hazardous waste.
  - The barging business is highly informal, involving both long- and short-term agreements.
  - Although changes are being made, crew training has been basically a learn-as-you-go operation.
  - Bulk shipments of hazardous materials and some hazardous wastes are under U.S. Coast Guard jurisdiction.
  - Under the Federal Water Pollution Act, an owner or operator may be liable to the U.S. Government for up to $14 million for an accidental discharge of a hazardous substance. Therefore, barge companies either demonstrate adequate self-insurance or purchase special pollution insurance.

d. Air Carrier

- The amounts of all hazardous materials shipped by air are negligible compared to other modes and are only a small portion of any air carrier's business.
- Small amounts of waste acids, metal shavings, and waste samples are among the hazardous wastes carried. Wastes that are not samples are usually shipped by air because the proper disposal sites are not locally available, or

because wastes are occasionally returned to manufacturers.

- Most people in the air transport business cannot recall instances of hazardous waste transport by air.
- The STOP regulations of the Airline Pilots Association (ALPA) control hazardous materials shipped on passenger airlines and many cargo airlines.
- ALPA is trying to ban almost all hazardous materials on passenger craft, and at this date has greatly restricted transport on passenger craft.
- Shippers continue to foist dangerous cargoes on airlines without proper labelling or packaging.

e. Pipeline

- Interstate and other major U.S. pipelines are not used for transport of hazardous waste.
- Local pipeline transport of hazardous waste may occur when a waste management facility is located in the midst of a concentrated industrial area.
- Municipal or other public authorities often use pipelines for sludge or sewage transport.
- Some mining operations and coal utilities use pipelines for waste transport. All those identified involved on-site disposal.
- In instances such as the Gulf Coast Waste Disposal Authority, the pipelining of wastewater may be subject to the Federal Pollution Control Act.
- There do not appear to be coherent, unambiguous standards for hazardous waste transportation by pipeline.

2. Off-Site Transport by Generators

- Approximately 4 percent of generators of hazardous waste self-haul to off-site disposal facilities; they haul 2-3 percent of the total amount of hazardous waste that moves off-site.
- The smaller rather than the larger producing companies are engaged in self-hauling.

- The tendency to self-haul is industry-dependent. For example, the leather tanning industry self-hauls about 25 percent of waste going off-site, and the waste oil re-refining or reprocessing industry self-hauls over 50 percent. Some industries such as metal smelting and refining do no self-hauling at all.
- The distance from the generator to the disposal facility is usually less than 10 miles; often no more than 1-2 miles.
- One haul per day in a dump truck is common practice.
- Types of vehicles used include flatbeds, tank trucks, and trailers, with flatbeds predominant.
- Although most companies claim that they follow DOT marking and labeling requirements, they expressed interest in clear guidelines for hazardous waste.
- Records are retained for at least seven years on the amount of waste shipped, the destination, and the means of shipment.
- Wastes are temporarily stored on-site from a few days to a few months.

3. Transport by Operators of Hazardous Waste Management Facilities

- Facilities and Services Provided
  - The majority of firms operate interstate both in terms of location of multiple facilities and transportation activities; however, there are few interregional operations. Intrastate operators tend to serve only a small section of the state.
  - Most are privately owned (or closely-held public corporations).
  - Both in terms of number of vehicles and employees engaged in transportation, the HWMF/transporters are relatively small companies.
  - Many firms representing themselves as HWMF/transporters in fact do not both transport and dispose of hazardous waste.
  - More than half of the operations have been in business 10 years or less.

- **Transportation Activities**

  - Tankers represent about 60 percent of the vehicles in use; flatbeds and vans less than 30 percent.
  - The average age of vehicles in use is between 9 and 12 years.
  - When the vehicle itself is not the container, the generator of the waste material is responsible for containerization.
  - Transportation employees' training focuses more on vehicle safety than on the hazards of the materials being transported.
  - Generators initiate the transportation activity. The service procurement agreement includes descriptions of the materials, and specifications of the terms and conditions of pickup and delivery.
  - Loading of the vehicle is usually the responsibility of the generator if the generator provides the containers; otherwise the HWMF/transporter takes responsibility.
  - There is little mixing of materials and multiple pickups are rare.
  - Some, but not all, HWMF/transporters chemically analyze materials either prior to or upon receipt of wastes.
  - There is always someone to accept delivery at the waste management facility.
  - Marking, labeling, and placarding are generally in accordance with DOT regulations, according to transporters.

- **Business/Administrative Practices**

  - Shipping papers, containing appropriate certification signatures and which describe quantity, source, waste type and delivery point, are maintained for at least three years.
  - There is some on-site storage of hazardous waste at treatment and disposal facilities.
  - All facilities indicate that they follow generally accepted or mandated safety practices.

II. INTRODUCTION

A. OBJECTIVES

The objectives of this study are to:

- Characterize the facilities, transportation activities, business/administrative practices, regulatory environment, and financial and economic structure of transporters of hazardous waste in the United States; and
- Assess the costs of compliance with and economic impact of EPA-proposed hazardous waste transportation regulations.

Such transportation is normally required to convey hazardous wastes from the generator of these wastes to an off-premises waste facility for treatment, storage, and/or disposal. All modes of transportation are addressed: air, rail, highway, waterway, and pipeline, for both inter- and intra-state movements.

The need for this study derives from enactment of the Resource Conservation and Recovery Act of 1976 (RCRA) (Pub. L. 94-580), which directs the Administrator of the Environmental Protection Agency (EPA), under Subtitle C--Hazardous Waste Management, of the Act, to promulgate regulations within 18 months of enactment to ensure the proper controls on generation, transportation, treatment, storage, and/or disposal of all wastes defined as hazardous by the Act. Specifically, Section 3003 (42 U.S.C. 6923) of the Act (RCRA) requires the EPA to establish standards applicable to transporters of hazardous waste as may be necessary to protect human health and the environment.

According to Section 3003, paragraph (a), the standards developed shall include but need not be limited to: (1) recordkeeping concerning such hazardous wastes transported, and their source and delivery points; (2) transportation of such wastes only if properly labeled; (3) compliance with the manifest system developed under Section 3002 of the Act; and (4) transportation of all hazardous wastes only to the hazardous waste management facilities which the shipper designates on the manifest form to be a facility holding a permit issued in accordance with Section

3005 of the Act. This study focuses on aspects of hazardous waste transportation related to these four requirements.

The costs of compliance estimates and economic impact assessment reported here are based upon "Standards Applicable to Transporters of Hazardous Wastes" proposed by the EPA, 43 FR 18506-18512, April 28, 1978 (reproduced in Appendix A). The economic impact conclusions are those of the Contractor and not of the EPA.

B. SCOPE OF WORK

Three groups of participants have been identified as transporters* of hazardous waste:

- Generator/transporter - Generators, including industrial, commercial, and governmental organizations, that act as private carriers and self-haul hazardous wastes, invariably by truck, to off-site hazardous waste management facilities.
- For-hire transporter - Common and contract carriers, whose principal business is commodity and/or waste transportation, that transport hazardous waste from the point of generation to off-site hazardous waste management facilities which they do not also operate.
- Hazardous Waste Management Facility (HWMF)/transporter - Operators of hazardous waste management facilities that act as contract or private carriers in transporting hazardous waste from the point of generation to treatment, storage, or disposal facilities.

In gathering information, it has proven quite difficult to apply the precise definition of hazardous waste contained in Section 1004 of RCRA: "a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may--

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*The transporter is, by definition, the party providing the motive power for the shipment. Thus, a generator of hazardous waste who owns and loads a rail tank car is considered a Generator/transporter only if that party were to operate the locomotive.

> "(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
>
> "(B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

Rather, hazardous waste has been liberally interpreted to mean "industrial or processing waste generally," under the reasonable assumption that most of such waste is hazardous. This simplification made it possible to more easily communicate the intent of the term "hazardous waste" to hazardous waste transporters from whom information has been elicited. All wastes which meet the Department of Transportation's definition of hazardous materials (see Section II.D.) have been considered hazardous wastes in this study.

The RCRA specifically excludes the following wastes from regulation under the Act: solid or dissolved material in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1342); and source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011). Furthermore, the following have been excluded from this study as not being within the current scope of RCRA: wastes destined for ocean disposal under the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1401 and following); and nonhazardous wastes such as municipal garbage and refuse generally, unprocessed septage and sewage, and discarded material from mining and agricultural operations.

C. INFORMATION ACQUISITION

A representative characterization of hazardous waste transportation in the U.S. is a principal goal of this study. This has proven to be difficult to achieve on several counts. First, the three segments combined do not truly constitute a readily identifiable industry. The generator/transporter certainly does not view itself as part of the hazardous waste transport industry; nor do many of the common carriers (e.g., trucking firms, railroads). Many hazardous waste management firms provide transportation only as a convenience to generators, and in furtherance of their principal service: waste treatment and disposal. Probably for this reason there are no comprehensive tabulations extant of firms providing hazardous waste transportation services.

Second, a fringe portion of the industry, variously termed by large transporters as gypsies, scavengers, or midnight dumpers, is supposedly irresponsible or poorly informed regarding proper operating procedures. These firms are said to undercut the established disposal costs of responsible carriers in handling hazardous wastes by illegally or imprudently dumping waste as may be convenient. The existence of such firms seems undeniable in view of the widespread dissatisfaction with and opposition to their activities; however, the true extent of their operations in transporting hazardous waste is undocumented and unknown. In this study, it has not been possible to characterize independently the nature and extent of this fringe segment.

To identify firms transporting hazardous waste contact was made with all EPA Regional Offices for Solid Waste Management, various Federal Government Agencies and national industry associations identified in Tables II-1 and II-2. With the exception of regional EPA contacts, very few of the Federal agencies and national associations were able to identify firms engaged in the transportation of hazardous waste, again primarily because this activity does not yet constitute a readily-identifiable industry.

A primary source for contacts with hazardous waste transporters was drawn from firms attending a series of EPA-sponsored public participation meetings held with generators, transporters, waste management facilities, state and local governments, and public interest groups to

TABLE II-1

NATIONAL ASSOCIATIONS CONTACTED

- Air Freight Forwarders Association of America
- Airline Pilots Association, International
- Air Transport Association
- American Association of General Contractors
- American Petroleum Institute
- American Trucking Associations, Inc.
- The American Waterways Operators, Inc.
- Association of American Railroads and Bureau of Explosives
- Manufacturing Chemists Association
- National Air Transportation Associations
- National Center for Resource Recovery
- National Solid Waste Management Association
- National Tank Truck Carriers, Inc.
- Slurry Transport Association
- Transportation Association of America (Hazardous Materials Advisory Committee)

TABLE II-2

U.S. GOVERNMENT AGENCIES CONTACTED

- U.S. Department of Defense
  - Military Traffic Management Command
  - Air Force, Director of Transportation
  - Director of Environmental Research and Development
  - Army Corps of Engineers
- U.S. Environmental Protection Agency, Office of Solid Waste
- U.S. Department of Transportation
  - Federal Aviation Administration
  - Federal Highway Administration
  - Federal Railroad Administration
  - Materials Transportation Bureau, Office of Hazardous Materials Operations
  - Office of Pipeline Safety
  - U.S. Coast Guard

discuss the development of Section 3003 standards. The public meetings were conducted in ten cities across the United States during February - May, 1977.

Various secondary sources of information were also used. Certain states operating a permit system or having a registration requirement for hazardous waste transporters were able to identify transport activities. Listings of firms were obtained for California, Indiana, Massachusetts, Michigan, New York, Texas, and a partial listing for New Jersey. These, of course, are highly industrialized states. Finally, we surveyed the Telephone Yellow Pages Directories for major metropolitan areas across the country under such headings as disposal contractors; chemical cleaning--industrial; oils--waste; pumping contractors; and waste reduction and disposal service--industrial. Once contact was made with a few hazardous waste transporters in an area, additional references were easily obtained.

The problem of developing a reasonably representative sample of firms engaged in transporting hazardous waste was not easily resolved due to lack of knowledge of basic "industry" characteristics. The number of firms engaging in transportation of hazardous waste by segment (or total) is unknown, as are their entry and exit rates. Although the total amount of hazardous waste transported by the industry has been estimated at 7.9 million (wet) metric tons per year in 1977,* the distribution of waste transported by firm is still unknown, so that it is difficult to judge the extent to which our findings are indeed representative of the industry. Nevertheless, an attempt was made to secure a representation of firms by geographic region served, size (number of employees or vehicles, revenues), public/private ownership, types of hazardous wastes handled, etc. To the extent that larger firms are more readily identified and tend to be more communicative than smaller firms, our sample is biased toward the former. Thus, the sample may be regarded as implicitly weighted by annual quantity of hazardous waste transported.

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*Reference 1. The estimate is based on hazardous waste generation from 13 industry groupings, rather than forecasting amounts received by the hazardous waste management industry. (Ocean dumping is included in the estimate.)

The problem of representativeness is probably most serious for generator/transporters and hazardous waste management facility/transporters due to their large numbers and fairly diverse activities (despite the fact that they engage exclusively in trucking). Regarding for-hire transporters (air, rail, highway, and waterway), the problem is not very significant because these common and contract carriers, which tend to operate inter-state, are more strictly regulated by Federal authorities (thus their activities tend to be relatively standard). However, intrastate motor transport of hazardous wastes may not be regulated by state or Federal authorities.

The information on which this report is based was obtained primarily through personal contact with firms engaged in hazardous waste transportation, supplemented by data made available by various state agencies and the EPA. No attempt was made to verify independently the accuracy of information obtained via day-to-day observation of transporter operations and records. In effect, the status of the hazardous waste transportation sector is reported here as revealed by that sector; no rigorous attempt has been made to verify these detailed findings. Site visits were made to obtain certain information first-hand and to corroborate basic findings.

The information gathering design essentially followed an "industry" sector/transportation mode matrix approach. Generators in major waste-producing industries were contacted to learn whether they self-hauled hazardous waste off-premises, and, if so, what modes were used. Hazardous waste management firms were contacted to learn whether they provided transportation services to generators in addition to operating treatment, storage, and/or disposal facilities, and, if so, what modes were used. Finally, for-hire common and contract carriers in each mode (air, rail, highway, waterway, and pipeline) that do not also operate treatment, storage, and/or disposal facilities were contatted to learn whether they engage at any time in transporting hazardous wastes, regardless of source and destination. Further details concerning methodology followed will be found in subsequent sections of this report dealing with "industry" segments.

D. REGULATORY CONTROL

1. Interstate Commerce Commission

Transporters of hazardous waste are currently subject to a variety of Federal, State, and local regulations. At the Federal level, the Department of Transportation (DOT) and the Interstate Commerce Commission (ICC) share principal regulatory authority over the transportation of hazardous waste.

The ICC under the Interstate Commerce Act has broad authority to administer regulations* involving the operating rights, financial structures, rates, and practices of transportation companies (nearly all carriers except air) engaged in interstate or foreign commerce. In particular, all non-exempt interstate carriers must make application to the ICC for operating authority** to engage in any for-hire transportation business. Important distinctions are made in the regulations among common, contract, and private carriers, as well as among the different transportation modes. Common carriers offer their services to the general public and are bound to carry for all who choose to employ them (for services they hold themselves out to perform) and are liable as insurers for the loss or injury of property, with certain exceptions. Interstate common carriers must hold a certificate issued by the ICC, which limits services to a specific geographic area and often to specific commodities. Contract carriers engage in for-hire transportation of passengers or property under individual contracts or agreements. Private carriers transport their own property, incidental to and in furtherance of their primary business (other than transportation); private carriers are generally excluded from regulation by the ICC (aside from safety considerations).

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* Pub. L. 89-670 (October 18, 1966) transferred to and vested in the Secretary of DOT all functions, powers, and duties of the ICC relative to safe transportation of hazardous materials.

** A certificate of public convenience and necessity for common carriers and permit for contract carriers.

The Interstate Commerce Act and the ICC have granted numerous regulatory exclusions which depend upon transportation mode, common/contract carrier status, property/cargo carried, etc. Many of these special situations, especially those pertaining to hazardous waste, are discussed in subsequent chapters of this report separately for each transport segment. Whether transportation of hazardous waste by motor vehicle is ICC-exempt depends upon whether it meets the test of property; at the present time, waste destined for disposal (rather than resource recovery) would appear not to do so (Section III.B.5).

2. Department of Transportation

The DOT has regulatory and enforcement authority to ensure the safe transportation of hazardous materials in interstate commerce. These broad powers extend to all modes of transportation and apply equally to common, contract, and private carriers. Generally, the DOT Hazardous Materials Regulations address acceptance of materials for transportation, loading, unloading, handling, storage of hazardous materials, leaking containers, accident/spill reporting requirements, containerization, and detailed requirements for specific classes of hazardous materials.

The DOT has stated (Office of Hazardous Materials Newsletter, April/May 1977) that, "The Department's Hazardous Materials Regulations may apply to any material regardless of its end use and the fact that a material is considered a waste material does not relieve application of these regulations." Thus, a waste that meets DOT's definition of a hazardous material (49 CFR 172, 173) is ipso facto a hazardous material subject to the Department's regulations. However, many hazardous wastes defined or listed under RCRA Section 3001 may not qualify as DOT hazardous materials, for example, certain persistent, toxic, environmentally-deleterious wastes; the transportation of those environmentally hazardous wastes are not currently regulated by the DOT.

DOT hazardous materials regulations as they may apply to the transportation of hazardous wastes are discussed in subsequent chapters of this report separately for each transport segment.

In addition to hazardous materials transportation regulations, DOT also administers safety regulations pertaining to the operation of transport vehicles (i.e., rail cars, freight containers, motor vehicles, vessels, cargo and portable tanks), aircraft and pipelines. Safety regulations for carriage by rail, water, and air apply to both intra- and interstate shipments. Further details concerning regulatory authority will be found in subsequent chapters for each hazardous waste transport segment.

A summary of both ICC and DOT regulatory authority with respect to transport of hazardous wastes appears in Table II-3.

3. State Authorities

Whereas ICC regulations pertain to interstate common and contract carriers, the individual states (Public Utility Commissions) exercise varying degrees of control over intrastate shipments of hazardous materials and wastes.* The vast majority of states (49 out of 50) require transporters to file for certificates of authority to transport hazardous materials. Of these, 38 also regulate waste transporters. Furthermore, various agencies in various states may require that a transporter of hazardous waste obtain a permit or license (e.g., Departments of Health, Natural Resources, Environmental Protection, Water Pollution Control, etc.).

Again, the individual states have exercised varying degrees of (intrastate) control over regulation of hazardous materials transportation and motor carrier safety.* About half the states have adopted DOT hazardous materials regulations for motor carriers in their entirety or have similar regulations in effect. About three-fifths of the states have adopted the DOT Motor Carrier Safety Regulations or have similar rules in effect.

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*For further details see Reference 2.

TABLE II-3

ICC AND DOT REGULATORY AUTHORITY FOR INTERSTATE TRANSPORT OF HAZARDOUS WASTE

Transport Segment	ICC	DOT
For-Hire Carrier		
Rail	Non-exempt	Non-exempt
Motor (truck)	Exempt/Non-exempt[a]	Non-exempt
Water (barge)	Exempt[b]	Non-exempt
Air	Exempt	Non-exempt
Pipeline	Non-exempt	Non-exempt
Generator/transporter	Exempt	Non-exempt
HWMF/transporter	Exempt[c]	Non-exempt

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[a] Exempt if waste is not "property."

[b] Bulk cargoes.

[c] Exempt if private carriage or waste is not "property."

E. INSURANCE COVERAGE

1. Types of Coverage

The ability of hazardous waste transporters to meet their financial responsibilities arising from loss of cargo is of particular concern to the EPA. In general, a firm may elect to self-insure (self-retention of risk) a portion or all of the risk of loss or purchase liability insurance for a specified amount of coverage. Liability insurance protecting a firm from losses related to transport of hazardous waste may be obtained in part through several types of insurance coverages: motor vehicle accident liability insurance, comprehensive general liability insurance, and "umbrella" liability insurance. Losses covered by such liability contracts include all legally obligated payments as a result of bodily injury or property damage. Insurance companies distinguish between two types of incidents which may be covered:

- Marine spills (both for offshore waters and inland waters); and
- Shoreside spills (i.e., onshore spills which may or may not eventually find their way into a waterway).

Insurance available to cover liability arising from hazardous waste spills is summarized in Table II-4.

Nearly all states have enacted financial responsibility laws for owners of motor vehicles. Most highly industrialized states (e.g., California, Indiana, Michigan) require insurance coverage per occurrence, typically $100,000 for bodily injury or death of one person, $300,000 for bodily injury or death of more than one person, and $50,000 for property damage to others.* Other states may require significantly less coverage (e.g., $10,000/$10,000/$1,000 in Louisiana; none in New Hampshire, Maryland, and New Jersey); still other states make special provision for transporters of hazardous

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*The ICC requires (49 CFR 1043.2) that these minimum limits be met by all regulated motor carriers, but does not set requirements for rail, water, or pipeline carriers.

TABLE II-4

SUMMARY OF INSURANCE COVERAGE AVAILABLE FOR HAZARDOUS WASTE SPILLS

	Clean-Up Spill Liability	Third-Party Liability
Marine		
Smaller Firms	WQIS[a]	WQIS
Larger Firms	Self-Insure	London Market Self-Insure
Shoreside		
Production Facilities	MVA/CGL[b]	MVA/CGL
Railroads	MVA/CGL	MVA/CGL Self-Insure
Trucking Firms	MVA/CGL	MVA/CGL

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[a] Water Quality Insurance Syndicate

[b] Motor Vehicle Accident and/or Comprehensive General Liability Insurance

SOURCE: Arthur D. Little, Inc., based on industry interviews.

materials (e.g., California, Kentucky). Motor vehicle liability coverage specifically extends to injuries and damages attributable to accidental loss of cargo.

Beyond motor vehicle insurance, most firms will carry comprehensive general liability insurance, covering all sources of liability not specifically excluded. Bodily injury and property damage payments are subject to separate policy limits per incident, usually tied to a deductible amount. Umbrella insurance is excess insurance over the insured's traditional liability insurance policies and may also cover sources of liability not covered under the insured's other liability policies, usually subject to a minimum deductible of $25,000 per occurrence. The maximum limit of liability under the umbrella insurance is usually at least $100,000 per occurrence and may range as high as $25 million or more per occurrence.

Typical terms of insurance coverage are as follows:

- Production Facilities

  The Fortune* 1000 companies probably carry at least $20 million in excess liability coverage; the first 250 Fortune companies may carry $50-100 million in coverage. A major heavy chemical producer which occasionally transports its own wastes has $85 million in excess liability coverage above a $1-million general liability policy.

- Railroads

  Railroads generally carry $25-50 million in third-party property damage with large deductibles ($1-2 million). Practically speaking, railroads self-insure for minor incidents.

- Trucking Firms

  The larger trucking firms generally carry $25-50 million in coverage. Coverage is believed to vary greatly for smaller firms and to be significantly less.

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*Fortune Magazine annually ranks by sales revenues the largest industrial corporations in the United States.

The above insurance coverages for firms are often written as a package by insurers, rather than as separate policies. However, the cost, and indeed availability, of high-amount liability insurance is dependent on several factors: (1) the extent to which the supposedly high-risk portion of the business (e.g., hazardous materials) is supported by lower-risk business, (2) the total amount of insurance purchased, and (3) the insured's historical claims experience. With regard to coverage of liability stemming from handling (including transporting) of hazardous materials generally, insurance underwriters caution that each situation must be appraised individually on its own merits, and generalizations are difficult. There is no question that smaller firms transporting hazardous materials and/or wastes are at a significant disadvantage in obtaining sufficient liability insurance. Firms with blemished safety records will not easily obtain coverage.

The foregoing liability policies are strictly limited to sudden and accidental (so-called measurable) loss situations. For example, loss of cargo due to tank corrosion would be excluded.

Self-haulers of hazardous wastes would ordinarily carry standard limited-liability motor vehicle insurance, covering personal injury and property damage, in accordance with regulations set by the state. Financially sound companies, self-hauling wastes under conditions where the probability of catastrophic accident is not too great, might be eligible for higher liability umbrella coverage for all losses, usually with a substantial deductible. When a generator contracts for waste transport, the contract normally has a clause transferring possession of the waste to the contractor, who then assumes all subsequent responsibility. The advantage of being able to transfer liability for hazardous materials which are of no further use to the company (i.e., hazardous wastes) is certainly an important factor accounting for the very small number of generators that do self-haul.

2. Shoreside Spills

Insurance coverage is generally available for shoreside liabilities, including clean-up costs which might result from a hazardous material spill, through comprehensive general liability insurance. Such policies provide some protection against hazardous material spills, where the spills are sudden and accidental. Recently, because the liability resulting from onshore spills is relatively vague, some insurers have been reluctant to provide this pollution coverage under their comprehensive general liability insurance. Nevertheless, coverage of sudden and accidental spills is still generally available. However, in general, it is not possible today (except possibly in London insurance markets) to obtain liability coverage for oil spill clean-up of the water environment. In no case will voluntary clean-up of spills or restoration of the environment by the insured be paid for by insurers; the business firm must be held legally responsible before insurance will be paid.

In recent years, companies insuring corporations that produce or transport hazardous materials have become increasingly concerned with potential liability due to spills. In general, clean-up costs and third party property damage costs due to most recent chemical spills have been small, and insurance companies have not had to reimburse insured corporations for damage because costs were within the amount of the deductible.

3. Marine Spills*

Coverage for marine spills is provided by at least one insurance syndicate, The Water Quality Insurance Syndicate (WQIS), a recently formed consortium of 28 marine insurance companies. The syndicate insures commercial marine vessels (tankers, barges, tugs, etc.) but not drilling rigs or recreational vessels, providing coverage for spills of petroleum or hazardous chemical substances as determined by the 1972 and 1977 Clean Water Acts. Most large carriers prefer to self-insure themselves against possible spills, while many small carriers prefer outside coverage. The majority of vessels insured by WQIS are American Flag vessels.

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*See Section III.C.4.f for further details.

Current insurance coverage for hazardous substance spills covers clean-up costs of up to $150/ton under policies ranging in size from a minimum of $250,000 to a maximum of $14 million per incident. Additional insurance coverage can be purchased for third-party property damage. For example, WQIS will provide up to $5 million coverage for third-party property damage under standard policies and an additional $10 million under special policies, while some London-based firms will provide up to $30 million coverage. As of June 1978, no claims for hazardous substance spills had been made to the WQIS because the list of hazardous substances had not been finalized.

4. Insurance Industry Concerns

The U.S. insurance industry is concerned that the potential liability due to hazardous material spills may be so great that it would be unable to provide sufficient coverage. In that case, many insurance dollars would flow to foreign markets, especially to London. The insurance industry is also concerned that clean-up costs may be defined to include mitigating measures as well as actual clean-up costs. Whether environmental mitigation expenses would be covered by existing insurance is open to question. However, actions required by Federal regulation and clearly made a responsibility of the spiller, such as clean-up costs, would probably be covered.

The entire issue of bonding and liability insurance for hazardous material spills is undergoing rapid development at this time. Most large industries appear to be adequately insured for clean-up costs and damages which have resulted from hazardous material incidents to date.

F. LIMITS OF ANALYSIS

1. Definition of Hazardous Waste

It has proven difficult to communicate unambiguously to transporters of waste the precise meaning of the definition of hazardous waste contained in Section 1004 of RCRA. First, several transporters denied that materials conveyed to resource recovery facilities constituted waste, hazardous or otherwise. Second, some transporters were not certain which, if any, of the wastes they customarily transported were indeed hazardous. Several interstate transporters believed, incorrectly, that DOT hazardous materials regulations do not apply to (hazardous) wastes. For these reasons, ambiguities understandably existed in the minds of several transporters furnishing information concerning the extent to which their operations involve hazardous waste.

2. Representativeness of Firms

Because the firms engaged in transportation of hazardous waste do not constitute a readily-identifiable industry, it has proven difficult to ensure that a representative sample of firms has been selected for examination. No consistent compilation of firms engaged in the transport of hazardous waste exists. Nevertheless, the consistency of responses obtained seems to indicate that a fairly broad spectrum of transporters has been contacted during this study, with the exception of those engaging in possibly illegal activities.

3. Illegal Activities

The extent of illegal or imprudent transportation of hazardous waste is unknown but widely reported to exist, particularly in those states lacking effective hazardous waste regulations. It has not been possible in this study to characterize the nature and extent of these fringe transporters.

4. Classification of Transport Segments

Difficulties were encountered in distinguishing unambiguously between 1) for-hire transporters not otherwise engaged in hazardous waste management and 2) hazardous waste management facilities that also transport waste. For example, some for-hire transporters contract with generators to both transport and dispose of hazardous waste. Often it was difficult to ascertain the true status of these transporters. In contrast, some hazardous waste management facilities provide transportation services which are quite distinct from their disposal operations. Actually, some of these transporters might be ICC-regulated common or contract carriers that also engage in hazardous waste disposal. Furthermore, various corporate or subsidiary relationships are possible between for-hire carriers and hazardous waste management facilities, which tend to confound the exact "industry" segmentation used in this study.

5. Verification of Information

Aside from several site visits to obtain basic information and to corroborate certain findings, no rigorous attempt has been made to verify the information provided by transporters of hazardous waste.

6. Restriction to Section 3003 Impacts

The economic impact assessment of RCRA Section 3003 regulations excludes the effect of all other RCRA regulations on the transportation of hazardous waste. For example, an assessment of the impact of Section 3004 regulations on the transportation of hazardous waste is not within the scope of this study.

7. Descriptive Data

The economic impact assessment reported here has been based largely upon descriptive data in the absence of detailed, statistically-supported findings. For example, the number of firms engaged in hazardous waste transportation and their total resources (number of vehicles, etc.) is unknown. Nor is it known how transportation revenues are divided between for-hire motor carriers and hazardous waste management facilities.

8. Compliance with DOT Regulations

All interstate transporters of hazardous waste are presumed to be in compliance with applicable DOT hazardous materials regulations. A separate economic analysis has not been made for those transporters in violation of these regulations. Specifically, no special provision has been made to recognize on-going illegal hazardous waste transportation activities (Cf. item 3 above).

9. Average Values

The cost of compliance estimates are average values. Substantial variability will exist in costs of compliance for individual transporters depending upon the precise nature and cost structure of their transportation activities.

G. SOME DEFINITIONS AND DISTINCTIONS

The generator of hazardous waste is regarded as the shipper or consignor of the waste. The transporter is the carrier of the hazardous waste, and the hazardous waste management facility is the recipient or consignee of the waste shipment.

In this report, comparisons are frequently made between DOT hazardous materials and hazardous wastes. The vast majority of hazardous materials are virgin materials or manufactured end products. Hazardous wastes differ from hazardous materials in two important respects:

- Hazardous wastes intended for disposal have no intrinsic economic value, and, therefore, the shipment need not be safeguarded for economic reasons (aside from potential third-party spill liability). On the other hand, loss of most hazardous materials means a financial loss to the owner or carrier, and for this reason such materials are regarded as "property," whereas waste per se is usually not so regarded.

- Whereas most hazardous materials have well-known and documented physical and chemical properties, the same is not true for most hazardous wastes. This means that most hazardous materials may be readily classified as to their hazards, whereas hazardous wastes are similarly classified only with great difficulty. Thus, it is not uncommon for many people who handle wastes to be unfamiliar with their hazards and the risks they represent.

H. ORGANIZATION OF REPORT

This report is organized by type or segment of hazardous waste transportation:

Section	Segment
III	For-Hire Transporter
A	Rail
B	Highway
C	Waterway
D	Air
E	Pipeline
IV	Generator/Transporter
V	HWMF/Transporter

The presentation within each category generally follows a parallel development:

- Method of Approach
- Facilities and Services Provided
- Transportation Activities
- Business/Administrative Practices
- Regulatory Control

The last three chapters concern the economic consequences of Section 3003 standards--the cost of compliance with regulations and their economic impact.

A glossary of special terms used in this report appears in Appendix H.

III. FOR-HIRE TRANSPORT

A. TRANSPORT BY RAIL CARRIER

1. METHOD OF APPROACH

Because railroad operating procedures are fairly standardized, four representative railroads were contacted to obtain information concerning the transport of hazardous waste. These four large interstate railroads were selected in part because they service together much of the United States. From the uniformity of the responses, it was inferred that contacts with additional railroads were not necessary. Discussions were conducted by telephone with personnel who were generally in charge of hazardous materials control and/or safety. In conjunction with these interviews, the Bureau of Explosives of the Association of American Railroads was interviewed both in person and by telephone. The Bureau of Explosives closely monitors regulatory developments and practices in the rail transport of hazardous materials. The Bureau of Explosives also supplied data on movements of hazardous waste. All organizations contacted are listed in Appendix B-1.

This general approach was effective in determining the range of standard practices followed in the transport of hazardous materials by railroad. Through follow-up discussions with these railroads, data on sample waste movements were obtained. A second stage of follow-up interviews was then conducted by telephone with disposers, recyclers, generators, and truck transporters who were identified as receivers of rail shipments or intermodal transporters. A total of seventeen such organizations were identified of which ten were interviewed. These organizations included a truck transporter who transfers waste from railroads, disposers and recyclers with direct rail connections, a rail switching terminal, a generator using intermodal transport for disposal, and a waste transporter and disposer who transfers waste from a local rail siding. The disposers and recyclers were in the Northeast, along the Gulf Coast and in California.

Considerable difficulty was encountered in identifying routes and specific movements for disposed hazardous waste as distinct from recoverable materials. The railroads identify a limited number of hazardous wastes in their hazardous materials classification system; the most prominent of these is spent sulfuric acid. Investigation of the movements of spent sulfuric acid showed that the destinations were all chemical companies recovering the acid. Discussions with disposal facility operators verified the existence of rail transport of hazardous waste and provided certain details of the operation, but did not identify specific movements. A reasonable conjecture is that railroad transport of hazardous waste is dominated by recoverable materials. In any case, the railroads' limited identification of hazardous wastes is biased toward resource recovery activities and points to the need for more specific identification of hazardous wastes.

2. FACILITIES AND SERVICES PROVIDED

The physical facilities and organizational structure of railroads are quite similar throughout the industry. The extent and nature of offered services distinguish railroads from other transportation modes. The railroads are generally large, publicly-owned corporations serving extensive regions of the country. Over 95 percent of the operating revenues of the railroad industry are earned by Class 1 Railroads (carriers having annual operating revenues of $10 million or more). The four railroads interviewed are all among the largest in the nation.

The services offered by the railroads include only pure transportation. Railroads are not directly concerned with the loading and unloading of transported goods. As common carriers regulated by the Interstate Commerce Commission, railroads must accept all properly packaged and labeled cargo tendered to them within their tariff. If a package is leaking or otherwise improperly prepared, the cargo, of course, is not considered to be adequate for shipment. However, in general, the shipper accepts responsibility for condition, description, packaging, and labeling.

One of the most significant aspects in the transport of hazardous materials (including waste) by railroad is that the shipper does all the packaging and the railroad does not directly handle the hazardous material. The shipper must provide to the railroad the sealed or closed containers of the hazardous material or waste. Furthermore, the railroad car in which the containers are placed must be sealed or closed when tendered. Thus, the railroad is concerned only with sealed or closed tank cars, flat bed cars with sealed containers, closed boxcars or other types of cars. Tank cars generally are sealed, although railroads can accept unsealed cars. The issue of a sealed boxcar, however, has less meaning than a sealed tank car. If hazardous wastes are sealed in drums, then the boxcar in which the drums are consolidated does not have to be sealed as such. In fact, for certain types of materials, an open hopper car can be used. However, regardless of the type of car, the railroad will accept only rail cars ready for shipment. Consolidation for delivery is often done by agent for several generators of hazardous waste. The railroads own and operate the flat cars on which the sealed containers are loaded and the other cars are owned or leased by the railroad, shipper, or a company which leases cars to the shipper. The extent of railroad preparation of material for shipment is limited to loading a closed container on the flatcar (at a piggyback loading ramp, for example).

The railroads do not provide storage and loading facilities. Both of these functions are performed by shippers on leased or private sidings.

3. TRANSPORTATION ACTIVITIES

a. Types and Quantity of Wastes Transported

Railroads transport a variety of hazardous materials, including hazardous waste. Based on waybill[*] samples in 1975 and 1976,[**] 3 percent of rail traffic is waste and scrap materials. This amount of material, which comprised over 690,000 carloads during the year studied, is predominantly non-hazardous but certainly includes a significant amount of hazardous waste. The types of wastes generally handled by the railroads (as well as other modes) can be found in the Hazardous Materials Table in 49 CFR 172.101 (Table III-1). The hazardous wastes identified in Table III-1 constitute a subset of the total of some 2000 hazardous materials identified by the railroads, 1300 of which have also been designated as hazardous materials by the DOT. (The transport of some of these commodities is examined in the next subsection.) Many hazardous wastes are not specifically identified in 49 CFR 172.101, coming under either a) headings which specify classes of commodities not otherwise classified, or b) commodities that can be either wastes or useable materials.

Table III-2 provides estimates of the annual volume (in carloads) of selected hazardous wastes shipped on U.S. railroads in 1976. The total of approximately 3300 carloads of hazardous waste is roughly equivalent to 200,000 metric tons, which when doubled (arbitrarily) to allow for incomplete sampling yields an estimate of some 400,000 metric tons of hazardous waste transported annually by rail, or approximately 5 percent of the 7.9 million wet metric tons per year of waste transported off-site. (Detailed analysis of 1412 carloads of spent sulfuric acid and four carloads of scrap battery parts shipped between nine origin-destination pairs revealed that on average each carload contained 69 metric tons of the former waste

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[*] The waybill is strictly a carrier document and serves as the historical record of shipment. It is prepared for each carload and less-than-carload shipment, from the shipping order, which is the carrier's copy of the bill of lading. All information contained on the shipping order which concerns the transportation of the shipment and the services to be performed by the carrier is transcribed to the waybill. It moves with the freight from origin to destination, regardless of the number of carriers over which the shipment is transported.

[**] 1977 Yearbook of RAILROAD FACTS, Association of American Railroads.

TABLE III-1

WASTES LISTED IN THE HAZARDOUS MATERIALS TABLE (49 CFR 172.101)

Acid, sludge
Aluminum dross, wet or hot
Aniline oil drum, empty
Arsenical dust
Arsenical flue dust
Bags, burlap, used*
Bags, sodium nitrate, empty and unwashed*
Barrel, empty*
Battery parts (plates, grids, etc.) unwashed, exhausted)
Black powder igniters with empty cartridge bag
Bottles, not cleaned*
Burlap bag, used and unwashed, or not cleaned
Burnt cotton, not repicked
Burnt fiber
Carboys, empty*
Cartridge cases, empty, primed
Container, reused or empty*
Cotton batting dross
Cotton waste or sweepings
Cotton waste, oily
Cylinder, empty*
Drums, empty*
Dusts, by-product, poisonous
Empty cartridge bag with black igniter
Empty cartridge case, primed
Excelsior (shredded wood)
Felt, waste
Felt, waste, wet
Fibers, burnt
Flue dust, poisonous
Garbage tankage
Gas drips, hydrocarbon
Grenade, empty, primed
Hair, wet
Iron mass or sponge, spent
Lead dross
Magnesium dross, wet or hot
Magnesium scrap
Metal borings, shavings, turnings, or cuttings
Nickel catalyst, wet, spent
Nitrating acid, spent
Oiled clothing or material
Paper scrap or waste
Propellant explosives in water, unstable, condemned, or deteriorated
Pyroxylin plastic scrap
Rags, oily or wet
Rocket ammunition with empty projectile
Rubber scrap or buffings
Sawdust and wood shavings
Sulfuric acid, spent
Tank car, empty*
Tank, portable, empty*
Tank truck, empty*
Waste paper, wet
Waste textile, wet
Waste wool, wet
Zirconium scrap

* Previously used for a hazardous material.

TABLE III-2

ESTIMATED ANNUAL VOLUME OF SELECTED HAZARDOUS WASTES SHIPPED ON AMERICAN RAILROADS

1976

Commodity	Carloads
Acid, sludge	94
Battery parts (plates, grids, etc., unwashed, exhausted)	71
Garbage tankage	1
Lead dross	8
Nickel catalyst, wet, spent	1
Nitrating acid, spent	80
Rags, oily or wet	73
Rubber scrap (only as hazardous material)	2
Sulfuric acid, spent	2965
Total	3295

Source: Association of American Railroads.

and 50 metric tons of the latter. With the assumption that carloads of other liquid and solid hazardous wastes contain similar masses as do carloads of spent sulfuric acid and scrap battery parts, respectively, the 3300 carloads contain 200,000 metric tons of hazardous waste.)

Most hazardous wastes received at disposal sites and reclamation centers are transported in a liquid state by tank car. Other materials, such as lead dross or magnesium scrap, are transported in gondola cars or hopper cars.

b. Nature and Extent of Services

Only a few of the surveyed disposal facilities accept hazardous waste by rail, and these do not receive substantial quantities. The railroad may deliver a few tank cars per shipment directly to a rail siding on the facility's property. Rail shipment is generally limited to large generators, particularly chemical producers, since they are more capable of filling tank cars. (A tank car can transport up to 34,500 gallons of liquid waste while highway cargo tanks are limited to 6,000 gallons.) Larger generators often own their own tank cars while smaller ones lease. Small waste shipments, of course, go by truck.

The relative dominance of large generators using rail often results in trips of great distances. The range of distances over which hazardous waste was transported included short distances (e.g., six miles) to very long distances (e.g., 2,000 miles). Most examples cited were on the order of hundreds of miles.

Most hazardous wastes are apparently transported to recovery facilities as opposed to disposal sites. For example, the most commonly transported hazardous waste identified by the railroads is spent sulfuric acid. Nearly all of this goes to recyclers who have rail sidings on their own property. Some of the origin-destination pairs for spent sulfuric acid include Salt Lake City, Utah to Martinez, California; Channelview, Texas to Nacadgoces, Texas; Baytown, Texas to Strang, Texas. Texas has numerous large recycling facilities that are prominent in the reclamation of several types of hazardous waste.

In addition to delivering wastes from private siding to private siding, the railroads are involved in intermodal transport, which is described in the next section.

c. Intermodal Rail Transfers

Transportation of hazardous waste by rail directly from origin to destination necessarily involves two facilities with private sidings. To obviate the need for both shipper and consignee to have private sidings, an alternative is intermodal rail transport. The extent of intermodal relative to unimodal rail transport is difficult to assess. However, its occurrence was cited by railroads, a very large disposal facility, a reclamation center, a truck transporter and a generator. It appears that intermodal transfers constitute a small but still significant portion of rail hazardous waste shipments.

The reasons for intermodal transfers are varied. Tank car movements do not often lend themselves to intermodal transfers, since direct transportation is less expensive and since generators that accumulate wastes can load tank cars in stages on their own rail sidings. However, many generators and disposers do not have their own rail sidings. One large disposal facility that does not have its own rail siding uses a public siding within a few miles of the disposal site. In this instance, tank trucks make several trips to unload the tank cars. Alternatively, smaller generators sometimes transport hazardous waste by truck to a railroad team track. A team track is a rail siding owned by the railroad for use by small industries. One instance of truck-rail piggyback transport of drums* to a disposal facility was cited, but this was admittedly an insignificant portion of total waste delivered to the disposal site.

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*Drums of waste in intermodal transport are said not to hold up well.

Finally, when water transport is involved, there is often an intermodal transfer involving rail. A large disposal operation in the Gulf of Mexico uses a barge operation that is preceded by a short trip by boxcar.

d. Railroad Equipment

Railroad equipment[*] in the United States averages 15 years old and is 16 percent leased by users. The 1976 car inventory is presented in Table III-3. As noted, most of the hazardous waste transported by rail moves by tank car, which are almost invariably owned or leased by shippers. Occasionally boxcars or covered hopper cars, primarily owned by the railroads, are used.

Many companies other than railroads own freight cars; some sixty non-railroads each own at least 300 rail cars. Most of these are used for crude or finished products but some are certainly used for waste.

New tank cars that carry hazardous materials have a maximum capacity of 34,500 gallons, while the maximum gross weight must not exceed 263,000 pounds. These tank cars, of course, have a much greater capacity than tank trucks and can haul materials more economically over long distances. These two reasons—available capacity and its cost—explain the role of railroads in hazardous waste transport. Most hazardous waste transport, however, is characterized by short distances and small quantities; thus, trucks are the usual mode of transport.

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[*] See Appendix C for illustrations of typical rail cars that haul hazardous waste.

TABLE III-3

INVENTORY OF RAILROAD EQUIPMENT IN UNITED STATES

1976

Type	Total	Class 1 Railroads	Other Railroads	Car Companies and Shippers
Box cars:				
Plain	302,899	281,663	10,812	10,424
Equipped	171,054	167,426	2,722	906
Covered hoppers	230,069	158,850	1,074	70,145
Flat cars	141,781	98,386	908	42,487
Refrigerator cars	98,017	74,936	2,956	20,125
Stock cars	3,637	3,559	--	78
Gondola cars	185,776	172,789	4,641	8,346
Hopper cars	365,526	343,186	9,859	12,481
Tank cars	168,018	2,905	17	165,096
Other freight cars	32,250	28,005	1,463	2,782
Total	1,699,027	1,331,705	34,452	332,870

Source: Association of American Railroads.

e. Containerization Practices and Personnel

Containers for transporting hazardous materials are specified by DOT regulations in 49 CFR 174, 178, 179. These define all types of containers, including smaller containers placed within railcars and the railcars themselves. Materials that are hazardous waste but not considered to be DOT hazardous materials must be contained according to the Uniform Freight Classification codes. As a result of the DOT regulations for tank cars and containers, these vehicles are generally dedicated for carriage of hazardous materials.

Railroad personnel are not involved in direct handling of hazardous wastes; they merely accept tendered shipments. Generator and disposal facility personnel, respectively, prepare and receive shipments. Personnel at disposal facilities are involved in the reception of wastes from all transport modes rather than specializing by mode. Certification of railroad employees involved in the transport of hazardous materials (or waste) is not required by Federal regulations. Employees are trained by the railroads, but as noted previously, carriers do not directly handle hazardous materials. DOT regulations are excerpted in the AAR Bureau of Explosives Pamphlet 20 for railroad employees, which serves as a useful working guide. The Bureau of Explosives offers special training courses in emergency handling of hazardous materials.

f. Operations

Prenotification of delivery is uncommon in the railroad industry. Dispatching and control in route is handled by railroad personnel. Interchange of carloads in rail shipments is common (over 50 percent of rail shipments are handled by more than one carrier).

The shipper certifies* on the bill of lading that the shipment conforms to DOT regulations; however, there is usually no formal verbal acceptance (documented or otherwise). After a rail car is accepted for delivery, the railroad simply delivers it to the consignee. The delivered car is moved to the appropriate rail yard or siding, at which time the consignee is duly notified. As noted previously, generator personnel (or a consolidating agent) load the shipment, and disposal or reclamation facility personnel unload it. For any hazardous material, proper storage facilities must be provided at the destination; for tank car contained material, loading cannot be done on a carrier siding unless a private one is unavailable.

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*49 CFR 172.204 requires that the shipper certify on the shipping paper that "...the above-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the DOT."

g. Marking, Labeling, and Placarding

DOT hazardous material marking, labeling, and placarding requirements are found in 49 CFR 172. Generally speaking, marking and labeling requirements apply strictly to the shipper, whereas placarding requirements apply to both the shipper and carrier.

In general, each rail car or container offered for shipment must be placarded on four sides if the car or container carries a DOT-specified hazardous material. Since some wastes are considered environmentally hazardous by the EPA but may not be a DOT hazardous material, marking, labeling, and placarding requirements do not presently apply to all hazardous wastes.

h. Handling of Spilled Materials

The larger U.S. railroads have departments dealing with safety and spill prevention or hazardous materials control, and maintain 24-hour emergency response offices. Field personnel have special training in leak and spill response, but in general the emergency offices rely on shippers, consignees and CHEMTREC* for assistance and advice. The shipper and consignee are usually notified first. Hazardous materials incidents must be reported at the earliest practicable moment to the DOT if death or injury requiring hospitalization occurs, property damage exceeds $50,000, or radioactive or etiologic agents are breached; a detailed report must be submitted to the DOT within fifteen days of the date of discovery (49 CFR 171.15-.16). In addition, leaking tank cars must be stopped in transit until repair is made.

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*Chemical Transportation Emergency Center, operated 24 hours a day by the Manufacturing Chemists Association.

4. BUSINESS/ADMINISTRATIVE PRACTICES

a. Shipping Documents

The relevant shipping documents for the transport of hazardous waste by rail are the bill of lading and the waybill.* The bill of lading, which includes such standard information as shipper, consignee, date, description of goods shipped, and routing, originates the shipment and is prescribed by the ICC in 49 CFR 1035. Additionally, it serves as 1) a receipt that the carrier received the property specified on the bill of lading, 2) the contract of carriage, and 3) documentary evidence of title to the goods shipped. Under the Interstate Commerce Act, Section 20(11), a common carrier must issue a receipt or bill of lading. Thus it is the carrier's legal duty to issue the bill of lading, although the shipper frequently does so as a convenience to the carrier. Any errors on the bill of lading which the carrier has sufficient information to detect when accepting the shipment, are the responsibility of the carrier. For hazardous materials, 49 CFR 172 requires that shipping papers (bills of lading) include: 1) proper shipping name, 2) hazard classification according to 49 CFR 172.101, 3) total quantity of material, 4) placard notation, and 5) shipper's certification that the shipment is in compliance with DOT regulations. The railroad is ordinarily required to accept faithfully the certification of the shipper.

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*For a more complete discussion of shipping papers for all modes of transportation, see Kenneth V. Flood, Traffic Management, Wm. C. Brown Company Publishers, Dubuque, Iowa, 1975. Another document is the freight bill, or the carrier's invoice.

The bill of lading is ordinarily presented to the authorized agent of the railroad and the railroad prepares a waybill for the train crew. The waybill is the document of transit and generally includes the information on the bill of lading plus the standard transportation commodity code and a special endorsement. At interchanges a copy of the waybill is forwarded or, if necessary, a new one is produced. At the destination office of the railroad, the waybill is sent to the accounting department for auditing and filing. The crew transferring the rail car to a private siding does not have to possess a copy of the waybill if the move is concon-sidered a switch or transfer. Upon delivery the consignee is notified, but there need not be any transfer of papers. For consignees owning rail sidings, notification is the act of delivery to the siding. For other consignees, notification is usually done with a delivery ticket.

The rail shipping documents for intermodal transfers are identical to those used on direct rail shipments: the bill of lading and the waybill. The railroad is concerned only with its part of the intermodal trip, i.e., from a single origin to a single destination. Additional paper-work does not arise. If the shipper uses additional carriers (e.g., a freight forwarder), then these carriers must have on file a copy of the bill of lading (certified if the material is hazardous). In the latter case, the freight forwarder does not have to certify its bill of lading to the railroad.

As noted previously, copies of the certified bill of lading and waybills must be kept on file by the originating carrier for at least three years (by ICC regulation). The railroads interviewed all maintain shipping data in an internal computer system.

Samples of shipping documents are presented in Appendix D.

b. On-Site Storage and Operator Training

As noted previously, there is no formal certification for railroad employees who transport hazardous materials. DOT regulations also affect, however, many other aspects of transit, handling, and delivery (49 CFR 174).

Some of these other regulations are highlighted here. In switching yards, loaded tank cars cannot be cut off until the preceding car or cars clear the ladder track, and certain tank cars with compressed gas cannot be set loose. No hazardous material of any type can be transported on a train carrying passengers. At delivery, hazardous materials must be removed from carrier property within 48 hours. At private sidings, secure storage must be provided or the consignee must receive it in person. Railroads do not intentionally store hazardous materials, although such may be the case during switching operations; nevertheless, 49 CFR 174.14 requires that movements be expedited.

c. Maintenance

Maintenance of tank cars is of particular importance. Punctures, the presence of contaminants, and rupture of tank car safety discs have been cited by railroads as potential problems in the carriage of hazardous materials. Tank car integrity in general is the responsibility of the shipper. The railroad is required to inspect tank cars when offered for transport initially but the shipper is required to maintain the car in proper condition thereafter.

d. Insurance

The larger railroads are primarily self-insured up to at least $1 million for both the cost of spill clean-up and for potential bodily injury and property liability claims. There are no Federal financial responsibility requirements to meet carrier liability, but most railroads carry high amount umbrella policies covering sudden and accidental damage ($5 million up to $100 million) from such underwriters as Lloyds of London to cover both personal and property liability and involuntary spill clean-up.

5. REGULATORY CONTROL

a. Safety

Federal regulations pertaining to rail transport of hazardous materials are found in 49 CFR 171-174, 178, 179. All railroads and other parties interviewed stressed the high degree of compliance with DOT regulations. These regulations identify hazardous materials and stipulate the containerization, handling, loading, and placarding requirements described earlier, some of the record-keeping procedures, and certain safety procedures. Identified hazardous materials number over 2,000 and are assigned to hazard classes. Handling, loading, switching, location within train and delivery practices are often broken down by hazard class.

The Federal Government has traditionally exerted strong pressure in the areas of railroad safety and the transportation of hazardous materials. Accidents in the late 1960's led to promulgation of improved standards for certain tank cars. These accidents resulted from tank cars that were uninsulated and were carrying up to 40,000 gallons of cargo. Revised standards limit tank cars to a capacity of 34,500 gallons, require head shields for uninsulated, pressurized cars, and restrict handling of these tank cars in railroad yards. In the Federal Railroad Safety Act of 1970, DOT assumed jurisdiction over all aspects of railroad safety including standards for track, brakes, couplers, signal systems, locomotives, freight cars and other equipment, operating rules, hours of service of employees, etc; these regulations are found in 49 CFR 211-257. States are allowed to have more stringent regulations where a particular local safety hazard exits.

The military services have their own set of Joint Services Regulations, which largely reiterate DOT regulations. Each military service has its own transport department, and the Military Traffic Management Command (MTMC) arranges for commercial carriers and monitors regulations. Compliance, however, is the responsibility of the individual military services.

b. Business Practices

As common carriers subject to the provisions of Part I of the Interstate Commerce Act, railroads are obliged to accept for delivery any commodity in their tarrif that is properly packaged and tendered for shipment. Railroads are required under 49 CFR 1220 to preserve certain records for minimum periods of time. Specifically, the shipping documents cited in Table III-4 must be preserved for at least three years.

Railroads are also required under 49 CFR 1248 to compile and report freight commodity statistics on the basis of a 5-digit Commodity Classification for Transportation Statistics (49 CFR 1248.100). Unfortunately, the commodity code does not specifically identify hazardous wastes, but does classify waste generally as shown in Table III-5.

6. SOME REGULATORY COMPLIANCE PROBLEM AREAS

The railroads contacted all expressed satisfaction with the DOT hazardous materials regulations and with the 49 Series Standard Transportation Commodity Code (STCC), as it applies to hazardous materials. The STCC code may be of considerable value in the event of an accidental release of hazardous wastes. The system can potentially identify 100,000 hazardous materials. The first 50,000 numbers available have been set aside for identification of DOT hazardous materials. The remaining 50,000 numbers are available for identification of hazardous waste, hazardous substances, or other materials which are deemed

TABLE III-4

SHIPPING AND AGENCY DOCUMENTS TO BE PRESERVED

(49 CFR 1220)

Bills of lading and releases:

(a) Consignors' shipping orders, consignors' shipping tickets, and copies of bills of lading, freight bills from other carriers and other similar documents furnished the carrier for movement of freight

(b) Shippers' order-notify bills of lading taken up and cancelled

Freight waybills:

(a) Local waybills

(b) Interline waybills received from and made to other carriers

(c) Company freight waybills

(d) Express waybills

Freight bills and settlements:

(a) Paid copy of freight bill retained to support receipt of freight carges

(b) Paid copy of freight bill retained to support receipt of freight charges to other carriers

Other Freight Records:

(a) Records of freight received, forwarded, and delivered

(b) Notice to consignees of arrival of freight; tender of delivery (two year retention)

TABLE III-5

COMMODITY CLASSIFICATION FOR TRANSPORTATION STATISTICS (49 CFR 1248.100)

Code	Description
40	WASTE AND SCRAP MATERIALS
401	Ashes
402	Waste and scrap, except ashes
4021	Metal scrap, wastes and tailings
40211	Iron and steel scrap, wastes and tailings
4022	Textile waste, scrap and sweepings
4024	Paper waste and scrap
4026	Rubber and plastic scrap and waste
42	CONTAINERS, SHIPPING, RETURNED EMPTY
421	Containers, shipping, returned empty, inc. carriers or devices
422	Trailers, semi-trailers, returned empty

hazardous by regulatory agencies other than DOT. These numbers will be assigned by the Bureau of Explosives and used by railroads in developing emergency response and data retrieval systems.

At present whether a waste is a hazardous material is dictated by the regulations found in CFR Title 49. Clearly, all environmentally hazardous materials and wastes are not presently covered by DOT regulations. The railroad industry believes that EPA regulations for hazardous waste transport should conform to the current DOT requirements, including commodity identification and establishment of a new classification system, if needed. The railroads are concerned that conflicting, overlapping, and/or contradictory hazardous waste regulations would create a highly confusing regulatory environment.

B. TRANSPORT BY MOTOR CARRIER (FOR-HIRE)

1. METHOD OF APPROACH

a. Sampling

This section characterizes the transport of hazardous waste by for-hire motor carriers (common and contract) that are not also engaged in the operation of hazardous waste management facilities (treatment, storage, or disposal). These carriers convey hazardous waste from the generator's premises to the place of treatment, storage, or disposal.

Initially, only very limited information identifying for-hire motor carriers was available. A first step was to contact various national associations, such as National Tank Truck Carriers, Inc. and the American Trucking Associations, Inc. (see Table II-1). These associations did not have information readily available on members who were transporting (hazardous) waste. Regional EPA offices were then contacted to obtain lists of companies invited to and attending the ten regional public participation meetings on the development of RCRA Section 3003 standards; these listings offered only a few (12) for-hire motor carrier contacts. In preparing invitation lists, the regional EPA offices relied mainly on the individual state waste management offices to supply listings of transporters. The regional offices did identify those states which have hazardous waste transporter permit systems and those which have newly implemented programs.

Several states that have a transporter permit system or a registration requirement were contacted and a listing of companies requested. From the lists obtained it was necessary to identify those companies involved only in the transport of hazardous waste as distinct from those also operating hazardous waste management facilites. This information was compiled and later a "representative" sample was chosen for telephone contact or personal visit. Listings were obtained for California, Indiana, Massachusetts, Michigan, New York, Texas, and a partial listing for New Jersey.

Many of the states contacted had used the Telephone Yellow Pages Directory to collect names of transporters when a formal system for transport company identification was unavailable. Following this example, a survey was conducted of the Yellow Pages of major metropolitan areas across the country. Names were located under listings such as: pumping contractors; waste reduction, recovery and disposal--industrial; trucking--disposal contractors. Most of these companies were readily identified as HWMF*/transporters, but a number were also found to be for-hire motor carriers.

With the paucity of information available on the companies involved in for-hire motor carriage of hazardous waste, there can be no truly representative sample drawn for the purposes of this study. However, an attempt was made to develop information based upon a transporter sample using what is currently understood about the generation and disposal patterns for hazardous wastes. This sample addressed such variables as: geographical area; urban/rural; large firm/small firm; firms regulated by the State/firms not regulated by the State; firms which handle only (or mostly) hazardous wastes /firms which only occasionally handle hazardous wastes/firms which handle both hazardous and non-hazardous wastes on a regular basis, common/contract carrier, publicly/privately-owned firm, type of waste (by generating industry such as pharmaceutical, chemical, petroleum, batteries, etc.).

A total of 72 contacts were made with companies initially identified as transporters of hazardous wastes. These telephone calls resulted in the following:

Related and responding	36
Related and not responding	16
Not related	20
Not responding	6
Total	78

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* Hazardous Waste Management Facility

A listing of the companies contacted as transporters of hazardous wastes (excluding the generators and the hazardous waste management facilities that also transport) is presented in Appendix B-2.

2. FACILITIES AND SERVICES PROVIDED

a. Geographic Region Served

About half of the for-hire transporters contacted stated that they did not transport any hazardous waste across state borders. Others indicated that from 80 to 100 percent of their hazardous waste transport business was interstate. These figures may relate only to the companies contacted and may not be entirely representative. In addition, the quantities of hazardous waste transported inter- or intra-state could not be identified. In most cases, companies could not estimate even the total quantity of waste (hazardous and otherwise) transported. One firm reported transporting 40,000 gallons per week interstate; this was the only operation of the facility.

The for-hire transporters contacted range from firms that have one business location only to firms of national carrier status that have sixty or more terminals across the country. Most of the firms have only one location, several have between two and four locations. Transport companies are located where there is waste to transport. Where the concentration of industry is low, usually the generator or a hazardous waste management facility provides the transport.

b. Ownership

All firms contacted are privately owned or closely-held stock corporations (with perhaps the exception of Chemical Leaman and Matlack, Inc.).

c. Fleet Size and Number of Employees

The distribution of fleet size for the firms responding to this study is shown in Table III-6. Some of the national tank truck carriers have nearly 3000 tank cars in operation. Nearly all of these handle hazardous materials at some time, of which some portion also handle hazardous wastes. These common carriers generally have less than one percent of their business in hazardous wastes, and their records do not readily lend themselves to answering questions quickly on hazardous waste operations. Most firms contacted, however, had on the order of 1 to 30 trucks, with few vehicles devoted to the handling of hazardous wastes, though in some cases a stainless steel or specially lined tank truck was dedicated to caustic or corrosive wastes.

Firms were identified with 1 to 250 employees (excluding the larger common carriers). Anywhere from less than one percent to 100 percent of these employees were involved in transport. In those companies where less than 55 to 60 percent of their employees are involved in transport, the company was conducting another business activity, such as tank cleaning and maintenance. Often the transport firms have maintenance shop personnel and clerical help that made up the remaining 40 to 45 percent of the staff.

d. Services Provided

The transporter wants to provide a total service package to the client/generator. For this reason, some smaller transporter may accept a waste that he has never handled before and then search for a facility to accept it. If this proves to be difficult, the transporter might find it necessary to store the waste until a disposal facility is found. Nevertheless, transporters indicate that wastes are stored only on an infrequent basis and then only for a short time. One company described the time period as about a week.

Firms contacted vary from having less than 0.1 percent to 100 percent of their transport business in hazardous waste; however, the

TABLE III-6

FLEET SIZE DISTRIBUTION--FOR-HIRE MOTOR CARRIERS

Number of Vehicles in Fleet	Percent Of Total Vehicles
1-5	35
6-15	17
16-30	17
31-500	17
501-2000	5
2001-3000	9
Total	100

Source: Arthur D. Little, Inc., estimates.

total quantity of hazardous waste transported annually by these firms is unknown. Large interstate common carriers handle significant quantities of hazardous waste but it is only a very small portion of their business (less than 1 percent in most cases). Many other firms started out handling all kinds of waste and the "hazardous" label of their business came with the promulgation of state hazardous waste regulations.

Very sketchy information was made available on the nature of the wastes transported. The following kinds of wastes were mentioned by respondents: liquid/solid sludge, waste oil, solvent for recycling, general hazardous trash, paint waste, hydrocarbon waste, chlorine waste, acids (HCl, nitric), cyanide waste, caustic waste, hydrogen fluoride waste, cleaning solution waste, radioactive waste. Some transporters specialize in handling a particular waste such as waste oil or spent acid; most transporters handle various types of hazardous wastes. The frequency with which these wastes are collected varies considerably. Often collections are made only when requested; others are scheduled in advance, perhaps collections being made once a day.

Many estimates of the quantities of hazardous waste transported are suspect because the definition and interpretation of what constitutes a hazardous waste varies by state and by company within the state. Often the smaller transporters appeared unaware of the hazardous nature of much of their business. In addition, their view of hazard is colored by the wear on their trucks, the safety of their drivers, and the potential severity of any road accidents. Many do not think in terms of environmental contamination at this time.

Only one transport company was found to have its own laboratory facilities for analyzing wastes. This company also provides consulting services on the disposal of wastes, performing the analysis as a service to their clients (as well as for their own protection). Most of the transporters rely totally on the generator to supply any necessary analyses such as those to identify the material for disposal site approval, or for general characteristics as required for vehicle container specification. About 20 percent of those responding have contracted with an outside laboratory to provide chemical analyses for their clients, particularly for wastes the transporter has never handled before. The charge for the laboratory analysis is added to the generator's bill, but the laboratory is paid by the transporter.

The firms contacted have been in business from 5 to 58 years. Their activities in hazardous waste transport range from 1 to 58 years. For the most part, the firms have been transporting similar waste since they first started business. Obviously, the firms in business for 58 years have seen a marked change in the known hazardousness of the materials they handle. About 15 to 20 percent of the firms contacted state that they had operated for a number of years transporting relatively non-hazardous wastes prior to extending operations to include hazardous wastes. Many of the firms sense that there is a substantial growth opportunity in transporting hazardous waste.

3. TRANSPORTATION ACTIVITIES

a. Extent of Services

Firms that have diverse business operations were contacted. Some were servicing a metropolitan area, others an entire state, and still others transport waste several hundred miles for resource recovery or disposal. Most of the smaller operations have a service radius between 25 and 150 miles. Within those states where permits are required, the companies usually provide statewide service.

The typical distance per trip (two-way) ranges from 25 to 150 miles, the most frequently cited distance being 50 miles. This excludes the national common carriers who did not provide estimates (one, however, did indicate that 500-to 600-mile trips were normal).

b. Age and Types of Vehicles, Utilization Rate

The majority of the vehicles identified are tank trucks. There are a number of vacuum trucks (i.e., tank trucks with a vacuum unit attached for suction of liquids), and considerably smaller numbers of vehicles such as stake-body, flat-bed trucks (for hauling drums), dumpsters, compactors, dump trucks, "roll-off" trucks, hopper trucks, vans and pickups. Some of these are illustrated in Appendix C. Only one pressurized tank truck was discovered. Although mention was made of heated tank trucks used for hazardous waste, no transport companies were discovered who have these specialized vehicles. Excluding the national common carriers, there are eight times as many tank trucks as vacuum trucks, and far fewer still of all the remaining types of vehicles.

The capacity of tank trucks ranges from 1200 to 8600 gallons. Many firms have a fleet with the same size vehicles or only a couple of sizes, while others have a variety of truck sizes. This may indicate that the latter are acquiring trucks when bargains appear or are purchasing used equipment as it becomes available. The stake-body, flat-bed trucks are estimated to carry 35 to 65 drums. Some companies indicated their intent never to stack drums in more than one level to avoid the increased chances of spillage. Data obtained from the State of California's manifest system during the period November 1977-March 1978 indicate that the average quantity of hazardous waste shipped by truck (all carriers--common, contract, private) per manifest is 21.6 short tons, equivalent to 5200 gallons if the waste has a density equal to that of water (8.3 pounds/gallon). However, because a single manifest may suffice for multiple identical waste shipments between the same origin and destination points carried by a single truck on a given day, the cited average shipment quantity is likely to be biased high.

Those firms that responded indicate that most of their vehicles are under 6-8 years old--at most 15 years for a truck devoted to waste oil. Some companies did not know the "useful life" of their vehicles, while others stated that it ranged from five to ten years. Several companies responded that seven years is used for accounting (depreciation) purposes, but that "useful life" is considered to be about eight to ten years for all equipment, except the unlined vacuum trucks with an estimated useful life of five years. One firm purchased "good used equipment" and indicated that a used tank truck would last about three years.

Most of the companies contacted did not have data readily available concerning the intensity of vehicle use. This is understandable because many of the companies are small with little record keeping capability of this type. Small operations seem to rely on judgment to determine whether additional equipment is needed or whether maintenance is becoming a problem.

Some companies mentioned a ten-hour per day state-enforced time limit on their drivers. Others indicated that trucks are in use an average of 10 to 14 hours per day, including standing time. (In general, a truck is "utilized" whenever it is out of the yard.)

c. Containerization Practices

Hazardous waste materials move primarily in liquid bulk in tank or vacuum trucks; however, drums are used widely. Usually the generator contains the waste in the drums prior to collection. Three separate and independent estimates (by industry and state government) place truck (common, contract, private) transport of hazardous waste at 75 percent bulk (e.g., tanker) and 25 percent packaged (e.g., 55-gallon drums).

d. Transport Personnel

Most firms have only a one-man crew on each vehicle, particularly in the case of tank trucks and vacuum trucks. If drums are to be loaded onto a stake-body truck or into a pick-up or van at the generator's site, then a helper would occasionally accompany the driver. Few transport companies allow their employees to load drums, insisting that the generator do so with a forklift truck employing their own personnel, perhaps with some assistance from the driver.

e. Initiation of Transport Services

Arrangements for transport of hazardous waste are usually initiated in either of two ways: 1) generators contact transporters through recommendations and/or printed advertisements; or 2) generators respond to a transport company-originated "sales approach." Transporters then discuss with generators the waste stream in question, and the provision of waste samples for laboratory chemical analysis. The transporter then determines whether he is able to move the waste to appropriate facilities, designated or not by the generator. The more capable and experienced generators will usually independently evaluate the transporter's competence to handle the waste. Many small generators may give no consideration, except that of price, to the transporter's qualifications. At this time, transport charges are also discussed. If a mutual agreement is reached, the transporter may either arrange immediately a pickup schedule, or indicate that services will be rendered upon request.

Some transporters did indicate that multiple stops are made when drums are collected or when the clients are well-known and the wastes are compatible. This activity is not a general practice and appears to occur among small operations only.

f. Routing/Dispatching

Most firms who responded indicate that there is little time allowed for scheduling and routing; often as little as one hour to one day notice is given by the generator, even when a contract is signed for services. Some larger generators are serviced routinely, for example daily. To facilitate collection, trucks may be radio-dispatched.

g. Loading/Unloading

The process for loading and unloading trucks differs by the form of waste and type of vehicle (e.g., bulk liquid in tanks versus drummed waste on a stake truck). Tanks are unloaded and loaded via a hose coupling through a vacuum pump, pressure or gravity-feed mechanism. Drummed material or uncontainerized solid material may be palletized or may lie on the bed of the trailer. In the latter case, where the cargo lies on the bed of the trailer, the truck driver is heavily involved with loading and unloading operations and is required to manually handle the cargo.

A common delivery condition for cargo touching the truck bed is "tail gate delivery", whereby the truck driver moves the packaged cargo to the tailgate end of the truck, where it is removed by the recipient.

Another form is "hand-off delivery", whereby the truck driver hands the cargo to the recipient of the cargo. This latter method would be common where pails are the form of cargo container. In cases where the cargo is palletized, a forklift truck is typically driven onto the truck bed to remove cargo. In this case, the truck driver does not unload the truck.

Whenever a vacuum truck is used, the driver is responsible for loading the truck and unloading it at the disposal or treatment site. Wastes are pumped out of lagoons, diked areas and, in some cases, drums at the generator's location. Some difficulties were mentioned when pumping out of drums, e.g., mislabelled materials in drums or incompatible wastes to be mixed inside the tank. In one instance, the mixed waste created back-pressure in the tank, spraying the wastes out the suction hose. (No one was injured but everyone had to run for cover because the hose was whipping around.)

When stake-body trucks are used, the generator is normally responsible for loading with a forklift truck. Some transporters indicated that generally drums are not stacked on top of each other, and that drums will not be transported unless they are in reasonably good condition.

"Boxes" (i.e., roll-off containers and transfer trailers) were mentioned several times as transport containers for drums. In these cases, the generator is responsible for loading the drums into the container, and calling the transporter when it is full. Each transporter requires that the drums be loaded to their own specification and that the generator reload them if unsuitable. Unloading operations at the disposal site were not clear. Sometimes the disposal site would handle this operation.

The use of tank trucks depends upon the available equipment at the generator's site. With larger transporters requiring full loads, the generator will have on-site liquid storage tanks and the associated equipment for loading, which he will operate. Other transporters must contend with a wide variety of available loading equipment and must occasionally bring their own pumps.

Most transporters prefer contracts that require transportation to resource recovery operations, because there is considerable wear on their trucks at landfill sites. Except for liquids which the driver handles at the landfill (and drums that are occasionally rolled off stake trucks and pick-up vehicles into a disposal site), the disposal site seems to be responsible for unloading operations.

No one contacted considers leaking drums a problem. The transporters state that they merely refuse to transport leaking drums, and the generator must re-drum prior to shipment. In addition, no one indicated that a waste has ever been rejected by a disposal site (because the disposal facility is usually contacted prior to arrival to arrange for fees and schedules).

Multiple pick-ups are not made in transporting "boxes." The generator loads and pays for the entire container. Occasionally a stake truck will make multiple stops to pick up drums; however, the quantity loaded is unknown. The transporters indicated that attempts are made beforehand to determine if the wastes are compatible by the generator or an outside laboratory. Multiple stops usually require planning and are minimized by the need to respond quickly. Generators usually do not want any unnecessary delays in pick up.

Tank trucks usually operate on a full-load basis unless there are regular customers with compatible wastes. National common carriers make fewer multiple stops than other transporters. Small companies with fewer customers have less opportunity for arranging multiple stops.

h. Delivery to Disposal Site

Comments varied relating to the choice of disposal site to which hazardous wastes are transported. A few transporters carry to only one disposal site (typically a local landfill). Often this is a relationship based upon years of tradition, although such arrangements are being modified or rethought as new regulations are passed by individual states. In some cases the generator/client specifies the disposal site but this is not prevalent except for the national common carriers. Generators are, however, taking more interest in where their wastes are disposed.

Many of the firms contacted are offering a complete package that includes transportation and selection of disposal site, as well as furnishing to the generator requisite background on current regulations. Such background information has been of more interest to small and mid-size generators, or to those who only occasionally have hazardous wastes requiring transport.

Transporters commented on the relatively rapid change in regulations which is leading to fewer available treatment and disposal facilities and the limitation of some sites to specific wastes. They are hoping for an information center to assist them in locating appropriate hazardous waste management facilities. Currently, many transporters deal with a multitude of facilities, including landfill, incineration, treatment, and recovery operations.

Some operators of disposal facilities require prearrangements for disposal service while others do not. Disposal facilities that insist upon prearrangements usually do so for the following reasons: 1) to assure that the expected waste can be adequately handled at the facility; 2) to check on the validity of the transporter's permit and the status of his insurance coverage; and 3) to acknowledge any limitations on the quantity of waste that could actually be received for disposal. One firm stated that arrangements for delivery of waste must be made one day to one week in advance. These and other disposal facilities may require some form of identification upon arrival, in addition to the bill of lading, work ticket, or invoice forms normally carried.

Many transporters indicate that upon arrival at a disposal facility, a "man in responsible charge" examines the forms describing the waste load and accepts it with his signature. In the event that delivery is made after normal working hours, disposal site operators state that the trucker is either turned away by a guard or the waste is tentatively accepted by the guard pending chemical analysis and paper work to be undertaken on the following business day. The procedure for disposal varies among facilities. In some cases, wastes are unloaded and disposed of immediately; other facilities may perform a laboratory analysis before disposal occurs. In cases where the disposal facility also maintains pretreatment and/or resource recovery facilities, the wastes may be taken to storage areas. Disposers receive a copy of the forms describing the waste load, as do generators.

i. Marking, Labeling and Placarding

Only a few transport firms mentioned state requirements to have the company name and sometimes the vehicle number marked on the vehicle.

Transporters stated that they want more and better labeling but cannot force generators to do this. Labeling, in most cases, is not rigorously performed. Some generators stencil DOT-type labels on the drums. Others reuse the original drums and cross off the suppliers' names. Transporters did indicate that minimal or incorrect labeling of drums has caused some hazardous waste incidents.

Knowledge of placards varied; some companies are not aware of this identification method. All large interstate carriers contacted use DOT placards and follow all DOT and ICC regulations. About half the firms did not use placards; however, some of these are adopting DOT placards by January 1978. Some placards are permanent stencils (e.g., flammable); others are flip-type with eight to ten different designations. Companies suggested that the generator be required to choose and supply the appropriate placard for waste load identification.*

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*In fact, 49 CFR 172.506 specifies that it is the shipper's responsibility to provide the required placards to the motor carrier (in interstate commerce).

j. Handling of Spilled Materials

None of the transportation companies contacted stated the occurrence of a spillage. They did, however, mention the following agencies that would be contacted in the event of a spill:

- Highway patrol
- Fire department
- Main office of transporter
- State EPA office
- County health department
- U.S. Department of Transportation.

The notification requirements varied by state, type of transporter, and type of waste.

k. Intermodal Shipments

Only a few instances of truck/rail and truck/barge operations were observed; transporters, however, did not provide sufficient information on these operations. Discussion of rail/truck and air/truck will be found in Sections III-A3c and III-D3, respectively.

4. BUSINESS/ADMINISTRATIVE PRACTICES

a. Shipping Documents

The relevant shipping documents for common motor carriers are the bill of lading and the freight bill; these are entirely analogous to the rail shipping documents. The ICC (49 CFR 1051.11) requires that a receipt or bill of lading be issued by common motor carriers in interstate commerce, but does not prescribe the exact form as it does for rail carriage. The bill of lading (Appendix D) must include the names of the consignor and consignee; the points of origin and destination; the number of packages, description of the articles, and weight, volume, or measurement of the property received. For hazardous materials the DOT requires (49 CFR 172) that the shipper prepare and certify in writing as correct, shipping papers which describe the hazardous material (in the same manner as previously noted for rail carriage). Often the transporter completes the DOT shipping paper requirements for the shipper and then obtains the latter's certification on the document. However, when the motor carrier supplies the cargo tank for bulk shipments, no certification is required (49 CFR 172.204). According to DOT regulation (49 CFR 177.817) the shipping paper must remain at all times with the vehicle and in a prescribed location.

Generally speaking, the freight bill in the motor carrier industry performs both the functions of an invoice and a waybill. At the destination the delivery receipt copy of the freight bill is signed by the consignee and returned to the driver; the consignee's copy and the original freight bill are left with the consignee. The freight bill contains the following information in addition to that on the shipping paper: the date of shipment, the exact rate or rates assessed; the total charges to be collected; the route of movement indicating each carrier participating in the transportation service, and the transfer point or points through which the shipment moved.

All firms contacted maintain records. The terms used to describe relevant paper work include the following: generator bill, bill of lading, freight bill, weigh ticket, invoice, pay-slip, disposal papers, dumping slip, manifest, order request form, ticket system. Some of these records are required to be reported on a monthly or annual basis to state environmental departments. In most, but not all, cases, the shipping paper provides a description of the waste. In those instances where the waste is not identified well, it is listed as "miscellaneous processing wastes," etc. Often disposal site personnel are present to weigh trucks in and out, and to provide weigh tickets so that the disposal site could bill the transporter and complete the required state forms, if any.

The transporters contacted state that records were retained for at least five or seven years as a result of state, Internal Revenue

Service, and/or Interstate Commerce Commission regulations (3 years), in addition to general management practice. One firm, operating in the New England area, mentioned that records were also retained as protection against accident liability suits. In some states where record keeping regulations have recently been implemented (e.g., Indiana), the intent is to preserve the forms for at least five years.

b. Billing Procedures, Charges, and Contract Negotiations

Most companies bill generators for both transport and disposal, and often these charges are separately distinguished on the invoice. For certain interstate carriers, ICC regulations require that the haulage fee be a distinct item. It is difficult to tell from names or advertisements whether transporters do in fact have their own disposal facilities. While there are often yearly contracts, the transporters are still notified when the shipment is ready. The transporter arranges with the disposal site for disposal fee and schedule, and then bills the generator.

c. On-Site Storage

Most transporters emphatically stated that no storage for hazardous wastes was provided. Most of the firms contacted handle liquid wastes collected in tank trucks. To maintain access to these trucks, transporters will not use them as storage vehicles. No transporter was found with liquid storage on-site. A few firms did indicate that drums of wastes are stored at their location until a full load is available for transport to the disposal site, or until arrangements can be made with a disposal facility to accept the waste. One company described the length of storage as about a week on an infrequent basis. Transporters indicated that economic incentives governed on-site storage.

d. Driver Training/Licensing

No special licenses were found to be required for any of the drivers in companies handling hazardous wastes. The standard state truck drivers' licenses are the only requirements. The large interstate carriers stated that their drivers are thoroughly trained in precautions and use of safety equipment. Most other firms have only on-the-job training, or claim to hire experienced drivers only. Others have informal training which includes: one to three weeks of on-the-job training; two to three months of guidance by owner; informal discussion sessions--breakfast meetings; monthly meetings with guest speakers; weekly meetings on basic safety and truck operations; and quarterly meetings on basic safety and truck operation. One firm mentioned that they are starting a safety program with the help of the Occupational Safety and Health Administration.

e. Safety Practices

Questions related specifically to the use of safety equipment were not asked; however, it was discovered that most trucks carry fire extinguishers; interstate carriers are so required by 49 CFR 390-397. While mention was made of gloves, masks and goggles, it does not appear that safety equipment is considered a highly important aspect of operations, particularly with the smaller transporters who also handle non-hazardous wastes. The large interstate carriers are more versed in safety procedures.

f. Vehicle Maintenance

Many firms perform standard tank cleaning between loads (unless the vehicles are dedicated to one waste such as waste oil). Often standard maintenance involves only checks on tires and engines with other repairs made by outside personnel. For some firms, tank repairs are carried out by the firms' own employees.

g. Special State Regulations

About one-third of the firms mentioned some inspection or certification requirement other than the Standard State Vehicle Inspection required of all vehicles. Some states (including Massachusetts) require a one-time inspection at the initiation of a collection permit. Others (Indiana, for example) require annual re-inspections. The

California Health Department requires a once-a-year inspection. Some tank truck manufacturers certify the vehicles, re-inspect every two years, and recertify after five years as a service to their customers (required by DOT regulation).

The following miscellaneous comments were made in relation to relevant state regulations:

- Michigan requires a transport permit and surety bond in the amount of $15,000 for in-state companies and $30,000 for out-of-state companies.
- Texas specifies the minimum insurance coverage.
- California specifies the minimum insurance coverage. Answers varied from $200,000 to $500,000 and may depend upon the vehicle type.
- Oklahoma makes transporters liable for spills through negligence by imposing fines up to $25,000.
- Numerous states require collection permits and hauler certificates.

5. REGULATORY CONTROL

a. Safety

Federal regulations pertaining to interstate transport of hazardous materials by public highway are found in 49 CFR 171-173, 177, and 178. These standards contain regulations for acceptance of materials for transportation, loading, unloading, handling, storage of hazardous materials, leaking containers, accident/spill reporting requirements, containerization, and detailed requirements for specific classes of hazardous materials. Furthermore, motor carriers transporting hazardous materials in interstate commerce must comply with DOT Motor Carrier Safety Regulations (49 CFR 390-397). Many states have adopted DOT Hazardous Materials

Regulations and Motor Carrier Safety Regulations in their entirety or in part or have similar regulations in effect.* The foregoing regulations apply to transporters conveying hazardous wastes which meet the definition of hazardous materials.

b. Business Practices

ICC-regulated common motor carriers must accept for delivery any commodity in their tariff that is properly tendered for shipment. All motor carriers subject to the provisions of the Interstate Commerce Act are required under 49 CFR 1220 to preserve the shipping documents cited in Table III-4 for at least three years, and under 49 CFR 1248 to compile and report freight commodity statistics annually (see Table III-5 for waste and related codes).

Motor carriers engaged in the transportation of waste products for recycling or reuse in furtherence of recognized pollution control programs must file for a special certificate of public convenience and necessity (49 CFR 1062.1).

However, motor carrier transportation of hazardous waste considered by the generator to be devoid of economic value would appear to be ICC-exempt by analogy on the basis of a recent Commission ruling. On May 10, 1978, the Commission, in decision 129 MCC 339, declared that the transportation by a contract carrier of nuclear waste which had no economic value did not involve the movement of property and was, therefore, exempt. The Commission further declared that its responsibility with regard to assuring the safe handling of property was met by existing Nuclear Regulatory Commission jurisdiction. The analogy to the transportation of hazardous wastes which are also DOT-regulated hazardous materials is apparent.

Finally, all motor carrier transportation within specified commercial zones (e.g., New York City area) is generally exempt from ICC regulation (49 CFR 1048).

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* A state-by-state review of applicable state regulations will be found in Reference 2.

C. TRANSPORT BY WATER CARRIER

1. METHOD OF APPROACH

This section presents a characterization of hazardous waste transport by water on United States inland waterways. Because the quantity of hazardous waste transported by barge on inland waters appears to be small relative to the conventional truck and rail modes, it has been difficult to identify the number of carriers engaged in this activity and to assess transport operations as a whole. However, due to the nature of the barging business, it is fair to say that at one time or other nearly every firm engaged in for-hire barging, especially those conveying hazardous materials, may well transport hazardous waste. For these reasons, the information presented hereafter is of general nature on the facilities, the transportation activities, and the business and administrative practices of barge companies which transport hazardous waste.

Several water carriers known to transport hazardous materials were contacted initially; some were suggested by the American Waterways Operators. These companies supplied information when their operations related to this study, and often suggested additional information sources when they did not. A total of seven companies, largely barging operations, were contacted and are listed in Appendix B-3. They are located in Houston, New Orleans, St. Louis, and on the Ohio River. Obviously, the findings are limited by the few companies contacted and the method of contact; however, the consistency of information obtained indicates some degree of verification.

Because barges engaged in transporting waste for ocean disposal are governed by the Marine Protection, Research and Sanctuaries Act of 1972, investigation of these activities was excluded from this study. Four governmental agencies (Corps of Engineers, U.S. Coast Guard, Environmental Protection Agency, and Department of Commerce) participate under this Act by issuing permits, coordinating and monitoring activities, and enforcing regulations. Barge transporters must comply with RCRA when transporting hazardous waste to ports of exit, and when the barge is stored at dockside. From the time that the barge leaves the dock for the ocean disposal site, the Marine Protection, Research and Sanctuaries Act becomes effective.

2. FACILITIES AND SERVICES PROVIDED

The carriers contacted operate on all U.S. inland waterways. However, most shipments of hazardous waste move on the Gulf Intracoastal Waterway and Missouri-Mississippi River System portion of the U.S. waterway system. A typical one-way trip may originate in the Great Lakes region and terminate in the Houston area, a distance of approximately 1200 miles. No vessels other than barges have been found to carry hazardous wastes. Whereas most generators of hazardous waste who ship by rail supply their own rail tank cars, usually the barge line provides the vessel.

All companies contacted are privately owned. Most barge organizations are concerns of long-standing, in many cases passing from father to son. The companies generally operate as contract rather than common or private carriers.* In all cases, the majority of commodities handled are virgin materials. No company was found to transport hazardous waste exclusively, or even to a substantial extent. A spokesman for one company indicated that it was established in 1901, but had been involved with hazardous waste transport for the past ten years. For this company, waste transport constitutes less than 10 percent of total operations.

Most often, the hazardous waste transported on the inland waterways include waste glycol, spent acids, and spent caustics. They are in liquid bulk form, and it is very common for the industrial waste transported to have a water content up to 90 percent. All hazardous wastes transported by the companies interviewed go to resource recovery facilities.

The most commonly used barge for waste transport is a 3-compartment tank barge with a capacity range of 1200 to 1500 short-tons. Most barges used by the companies are double-hulled and some have double bottoms for grounding protection. Information regarding the age and utilization rate for the barges was not obtained. Illustrations of typical barges appear in Appendix C.

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*The Interstate Commerce Act (49 USC 903) exempts most carriers of bulk commodities by water, particularly liquid cargoes in bulk and tank vessels certified by the Coast Guard.

The key personnel in a hazardous material transportation by barge operation are generally seasoned veterans, having spent a lifetime on the coastal or inland waters. This would include the navigation and engineering officers aboard the towboat. There is, however, a very high turnover of the deck crew--sailors, etc. Many deckmen quit before a single trip is completed, or complete one trip and never return. College men to a great extent "sign on" for a trip as ordinary seamen (OS) because the money is good and a change of scene can be anticipated.

3. TRANSPORTATION ACTIVITIES

a. Prenotification and Acceptance

Arrangements for hazardous waste collection are made prior to the arrival of the barge. The crew members, who load the waste, have no involvement with the paper work. Shipping papers are placed on the barge by an authorized individual, who also records the quantity of waste loaded, but bill of lading and other forms are handled through the mail. There are several copies of the shipping papers. One copy remains with the barge; another copy of the papers is with the power vessel, along with a cargo information card that informs the crew members of the waste that is to be escorted and the precautions that should be taken.

b. Routing/Dispatching

Most barge companies follow specified travel routes in transporting cargo. To maintain an updated schedule of transport activities, there is constant oral communication by telephone or radio between the barge company, the facility shipping or receiving the waste, and the harbor terminals. The barge companies communicate with tow boat crews regularly to obtain information on the "daily position" of the fleet. It is not unusual for a barge during a trip to change tows one or more time, thereby being in the custody of different barge companies. The procedures of accepting and signing for the waste cargo vary with the operations of the barge companies. Oftentimes, shipments are accepted and transferred by radio communications. Any paper work is mailed before or after the activity occurs.

c. Loading/Dispatching

The loading of the waste into the barge is handled by a "tankerman." The tankerman can be either an employee of the barge line or a contracted individual retained by the vessel operator to handle loading or discharge in any geographical area. The tankerman, having proved his competency to the U.S. Coast Guard by obtaining a license for completing first aid and fire protection safety training, manipulates valves and onboard pumps in order to transfer the hazardous waste.

Generally, onshore pumps are used for loading and the pump or pumps on the marine craft are used for discharge. Either flexible hose lines or telescoping metal arms are used for the actual transfer. In either case, the transfer line is connected to piping manifolds on the shoreside pier and on the vessel itself. The entire operation is closely coordinated between the "tankerman" and the "dockman." The latter individual, usually a company employee, is responsible for all shoreside operations associated with the hazardous material transfer.

Once loaded, the barge is normally secured into a line of barges pushed to its destination by a "pusher" type tow boat. The number of barges involved in a single "tow" can be such that a bow thruster propulsion unit can be installed on the lead barge to handle the turns effectively in an inland waterway. The controls for the bow thruster are normally manipulated from the pusher tow boat. The discharge operation, from an operational standpoint, essentially duplicates the loading procedure in reverse.

As a general rule, the barges receive a full load at one stop and discharge their entire contents at the final destination.

d. Delivery to Final Destination

Upon arrival at the final destination, the waste cargo may be accepted immediately, or the barge may be placed in a queue, perhaps for several days. On occasion, particularly when the barge arrives at night, no personnel may be on hand to accept the shipment. The barge will then be tied up at the harbor terminal until it can be received. At this location, an authorized individual checks the quantity of waste unloaded against documents that have arrived several days in advance by mail. The shipping papers remain on the barge to inform cleaning crews of the previous contents. Subsequently, no one is particularly interested in these papers; they may be destroyed by a member of the cleaning crew or remain on board until they are replaced by new forms when the barge is reloaded.

e. Marking and Labeling

DOT hazardous material marking and labeling requirements for packaged (non-bulk) commodities are found in 49 CFR 172; these apply directly to the shipper. Although there is no label that defines a cargo as "hazardous waste," several labels are used that describe the danger associated with the hazardous waste being transported. In addition, red warning flags are positioned strategically on the barge.

f. Handling of Spilled Materials

No company indicated the occurrence of a spillage. The companies did mention that in the event of an incident involving hazardous materials the Coast Guard would be appropriately notified (in accordance with 46 CFR 2.20-65).

g. Intermodal Shipments

No substantive information was obtained regarding intermodal shipments of hazardous waste materials. A few companies did indicate the ability to coordinate operations with rail and truck modes at certain locations.

4. BUSINESS/ADMINISTRATIVE PRACTICES

a. Shipping Documents

The bill of lading, weigh ticket, and shipping manifest (Appendix D) are the commonly used shipping documents for transport of hazardous waste by water. These records serve several purposes which include billing, taxes, lost cargo claims, and compliance with regulations. Handling of the shipping papers has been previously described. The retention period for records varied among companies interviewed; however, 49 CFR 176.36 requires that shipping papers, cargo lists, and other documents be preserved by the carrier at his place of business or office in the U.S. for at least one year after their preparation (packaged commodities only). The companies stated that records are retained in current files for 5-7 years because of legal requirements, as well as administrative procedures. In the event of a marine casualty* (46 CFR 4.05), voyage records must be retained.

As described below, shipping paper requirements differ for packaged versus bulk cargo.

Packaged Cargo

Shipping paper requirements for vessels carrying DOT hazardous materials (excluding bulk carriage) are governed by 49 CFR 172, and include the complete description of the hazardous material (proper shipping name, hazard class, total quantity of material) and the shipper's certification. Each shipment by water must have the following additional shipping paper entries: identification of the type of packages (e.g., barrels, drums, cylinders, boxes); number of each type of pacakge; gross weight of each type of package or the individual gross weight of each package.

The above requirements directly apply to the shipper; however, the carrier may not transport a hazardous material by vessel unless the material is property described on the shipping paper as prescribed in 49 CFR 172.

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*Definition of marine casualty: (a) actual physical damage to property in excess of $1500, or material damage affecting the seaworthiness or efficiency of a vessel, or stranding or grounding, or loss of life, or injury causing any persons to remain incapacitated in excess of 72 hours.

Furthermore, the master of a vessel transporting hazardous materials must prepare a dangerous cargo manifest, list, or stowage plan (49 CFR 176.30). This document must be kept in a designated holder, on or near the vessel's bridge. It must contain the following information: name of vessel and official number, nationality of vessel, shipping name of each hazardous material on board, number and description of packages, gross weight for each type of packaging, classification of the hazardous material, additional description required by 49 CFR 172.203, stowage location of the hazardous material on board the vessel, and in the case of a vessel used for the storage of hazardous materials, the following additional information:

- Name and address of vessel's owner;
- Location of vessel's mooring;
- Name of person in charge of vessel;
- Name and address of the owner of the cargo;
- A complete record by week of all receipts and disbursements of hazardous materials, including the name and address of all consignors and consignees.

Each carrier who transports or stores hazardous materials on a vessel must retain a copy of the dangerous cargo manifest, list, or stowage plan for one year.

Bulk Cargo

Tank Vessels (46 CFR 35.01-10) and Unmanned Barges Carrying Certain Bulk Dangerous Cargoes (46 CFR 151.45-7)

Each loaded tank vessel (carrying liquid bulk cargo in tanks) must have on board a bill of lading, manifest or shipping document giving the name of the consignee (35.01-10) or shipper (151.45-7) and the location of the delivery point (35.01-10) or loading point (151.45-7); the kinds, grades, and approximate quantity by compartment of each kind and grade of cargo; and for whose account the cargo is being handled. Such manifests or bills of lading may be made out by the master, master of the towing vessel, owner, or agent of the owner. However, in the case of unmanned barges where shipping papers are not available, an entry in the logbook of the towing vessel giving the name of the shipper and location of shipping point, the name of the consignee and location of delivery point, the approximate kind, grade, and quantity of cargo in each barge of the tow, and for whose account the cargo is being handled, is considered adequate for compliance purposes.

Solids in Bulk (46 CFR 148.02-1)

In order to transport by vessel solid hazardous materials in bulk, the carrier must keep a shipping paper on board the vessel along with the dangerous cargo manifest. The information to be provided in these documents is essentially the same as for packaged hazardous materials. However, in addition the shipping paper must show the name and address of the U.S. shipper or his authorized representative and the dangerous cargo manifest must identify the hold(s) in which the material is being transported and the quantity of the material in each hold. The Master of the vessel must certify the correctness of the dangerous cargo manifest. Each unmanned barge transporting solid hazardous materials in bulk must have on board, in a readily retrievable location, such as a metal tube attached to the barge, a dangerous cargo manifest. Vessels, other than unmanned barges, must have the dangerous cargo manifest on board and kept in a conspicuous place on or near the bridge house.

Self-propelled Vessels Carrying Hazardous Liquids (46 CFR 153.908)

The shipping document requirements for tankships carrying flammable or combustible liquid cargoes in bulk are essentially the same as above. In addition, a cargo location plan must show the location and number of each cargo tank and the name of the cargo in each tank.

b. Billing Procedures/Contract Negotiations

Contracts are arranged before transport services are rendered. The barging business is highly informal; a large percentage of negotiations are conducted orally. There may be situations calling for long-term agreements as well as short-term agreements. Billing generally occurs following delivery of cargo. Customers may contact harbor terminals for information on the quantity of waste loaded and unloaded.

c. On-Site Storage

The companies interviewed stated that they did not have special facilities for storage of waste. Whenever the cargo cannot be unloaded, it simply remains in the barge.

d. Training/Licensing and Safety Practices

Until recent years crew training was largely a learn-as-you-go operation, with the more experienced crew members passing their knowledge, and unsafe working habits, on to the new crew member. However, this unsatisfactory situation is rapidly being corrected by action from both the fleet operators and unions. In this respect, the National Maritime Union of American operates an upgrading and retraining school in New York City. The finances for operation come from the Union's Pension and Welfare Fund with further financial assistance from the fleet owner/operators. Similarly, the Seafarers International Union operates a school at Piney Point, Maryland. There are also a number of private schools for individuals to study for license upgrading. All of the schools have special courses on pollution control with special emphasis on the handling of hazardous cargoes.

The Coast Guard is preparing guidelines which will clearly define training and licensing procedures. Presently, barge companies simply submit a form of certification to the Coast Guard indicating that a crew member has received training.

Safety requirements for loading are largely an inplant responsibility, with some Federal regulations that must be followed during a loading operation. Federal requirements are directed to flexible transfer hose testing, flying of flags and illumination of the area to indicate the transfer of hazardous cargo.

e. Equipment Maintenance

The certification and inspection of all marine craft is under the jurisdiction of the U.S. Coast Guard. Every two years, the barges are dry-docked for examination. A USCG marine inspector performs the routine check to determine whether the barge may be used in future transport activities.

f. Insurance

Information made available by companies regarding insurance coverage was not specific. However, according to one of the nation's largest insurance brokers, barge fleets are rarely insured under a standard policy, although a standard policy of insurance is available. Most marine transportation organizations prefer custom-tailored policies. Basic insurance is provided and readily available for the transportation vessel itself. In the marine insurance market, the phraseology "property and liability damage" is not used, "protection and indemnity" being the standard term.

Regarding insurance, the Federal Water Pollution Control Act stipulates that the owner or operator shall be liable to the United States Government for the cost of removal of any discharge, such cost not to exceed $100 per gross ton of such vessel, or $14 million, whichever is less. The owner or operator is required to provide evidence of financial responsibility by insurance bond or otherwise. Costs can include the removal and destruction of a vessel prior to discharge if it has created a "substantial threat of a pollution hazard."

To protect against massive claims resulting from a pollution incident, the major insurance companies have formed an organization known as the Water Quality Insurance Group (WQIG), through which they share the profits and losses on an invested percentage basis. Until September 1, 1976, any insurance carrier could sell Hull and Protection and Indemnity insurance. Since that date it has been exclusively written by WQIG. Non-member companies continue, however, to sell Hull and P&I coverage. A chemical or oil cargo can be insured either by the owner, shipper or consignee.

Coverage is possible up to the maximum limit of $14 million. An owner of a vessel which is in excess of 300 gross tons must, under Federal law: 1) carry insurance; 2) be self-insured, or 3) hold a bond or bank account to cover full financial responsibility. None of the listed requirements are needed for vessels under 300 gross tons. The WQIG policy is in two sections. Section A provides for liability to the Federal government for the costs of the cleanup action; Section B provides for third-party liability.

Under the present arrangement, WQIG does not write for loss of life or personal injury. They are responsible only for resulting property damage. Currently 1300 applicants are on file with WQIG for third-party liability. The ratings of the policy vary even though a rate structure has been established. However, the premium for hazardous materials, under which hazardous waste materials would be considered a category, is higher than that for oil.

Coverage under Section B of the policy is developed by an underwriting formula.

REGULATORY CONTROL

a. Safety and Pollution

Federal regulations pertaining to water transport of packaged hazardous materials are found in 49 CFR 171, 172, 173, 176, and 178. The bulk carriage of hazardous materials by water is governed by 46 CFR 30-40 (Tank Vessels); 64 (Marine Portable Tanks); 98 (Certain Dangerous Cargoes in Bulk); 148 (Solids in Bulk); 151 (Unmanned Barges); and 153 (Self-Propelled Vessels Carrying Hazardous Liquids). These standards contain regulations for acceptance of materials for transportation, loading, unloading, handling, storage of hazardous materials, leaking containers, accident/spill reporting requirements, containerization, and detailed requirements for specific classes of hazardous materials.

In addition, the remainder of CFR Title 46 (Shipping) bears on the general subject of marine and vessel safety.

Regulations promulgated and enforced by the Coast Guard pertaining to pollution of the nation's waterways are found in CFR Title 33, Subchapter O, specifically:

33 CFR 151	Oil pollution regulations
153	Control of pollution by oil and hazardous substances, discharge removal
154	Large oil transfer facilities
155	Vessel design and operations
156	Oil transfer operations
157	Rules for the protection of the marine environment relating to tank vessels carrying oil in bulk

The barge companies contacted indicated that they observe all DOT (CFR Title 49) and Coast Guard (CFR Title 46) regulations.* Incidents and/or discharges involving oil and hazardous materials or substances must be immediately reported to the Coast Guard in accordance with 46 CFR 2.20-65 and 33 CFR 153.203.

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*Barging activities on inland waterways are considered interstate operations and subject to Federal regulation; however, states may impose their own regulations as well.

b. Business Practices

Water carriers operating as common carriers subject to the Interstate Commerce Act (Parts I and III)* are obliged to accept for delivery any commodity in their tariff that is properly tendered for shipment. Regulated common and contract carriers are required under 49 CFR 1220 to preserve the shipping documents cited in Table III-4 for at least three years, and under 49 CFR 1248 to compile and report freight commodity statistics annually (see Table III-5 for waste and related codes). Under the River and Harbor Act of 1922 (33 U.S.C.A. 553), waterborne traffic movements must be reported to the Corps of Engineers, Department of the Army, by all vessel operators of record on prescribed forms for those movements of their vessels which were classified as domestic traffic. The four-digit commodity classification codes pertaining to waste and scrap materials and tonnages shipped in calendar year 1976 are reported in Table III-7. The portions of these wastes that are hazardous is unknown.

TABLE III-7

COMMODITY CLASSIFICATION FOR DOMESTIC WATERBORNE COMMERCE

GROUP 40 - WASTE AND SCRAP MATERIALS

Code No.	Item Name	Tonnage[a], CY 1976
4011	Iron and steel scrap	2,111,425
4012	Nonferrous metal scrap	189,455
4022	Textile waste, scrap, and sweepings	28,521
4024	Paper waste and scrap	35,668
4029	Waste and scrap, not elsewhere classified	15,101,599

[a] Tons of 2000 pounds

SOURCE: Waterborne Commerce of the United States, Calendar Year 1976, Part 5--National Summaries, U.S. Army Corps of Engineers, page 9.

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* 49 USC 903 exempts most water transportation of bulk commodities.

6. CASE EXAMPLES

a. Example 1

As a contract carrier, the company enters into a contract of affreightment with a shipper to deliver a specified hazardous waste to a consignee. The great bulk of commodities handled are virgin materials, but some waste materials (e.g., waste glycol, spent sulfuric acid) are handled. Waste handled is almost always in liquid form and carried in tank barges. Very occasionally, barrels of waste are handled, but no other type of contained waste.

Depending on the locations of the shipper and consignee, the company may make arrangements for other barging companies to provide tows along the route. That is, several different barging companies may temporarily take possession of the barge, each conveying it to a location where still another barge company will provide a tow over a subsequent portion of the route. The result of this procedure is that final delivery of the company's barge to the consignee will often be made by a towing company other than the one that initially took possession of the cargo.

The originating company is primarily in the spot transportation business, conducting little in the way of dedicated tows (operating the same barges between docks). It serves the midwestern United States, particularly the Mississippi and Ohio Rivers. It is very difficult to cite a typical distance hauled. Barge movements may be made from one dock in a harbor to another dock in the same harbor, or from the Ohio River Valley to Houston, Texas City, or Galveston, a trip of about 2000 miles.

According to DOT regulations, shipping papers must remain on the barge, rather than with the towboat. Again, this is because the barge may be towed by several different fleets. Typically, the company radios instructions to its tow boats, indicating the location, contents, and timing for pickup and delivery.

The barge business is largely conducted by telephone, with a good deal of trust on both sides. An invoice will ultimately be sent to the shipper for services rendered, but certification of delivery or other formal evidence of delivery or handling is not usually required.

The price for barge shipments is usually determined by the type of material (hazardous nature or difficulty of cleaning tanks) and distance hauled (ton-miles). It is quite difficult to carry more than one type of hazardous material in a barge, and in no case will incompatible materials be placed in different compartments.

The company is self-insured.

b. Example 2

This company, established in 1901, operates as a contract carrier out of the New Orleans area. It has 350 employees with 290 engaged in boat-work; the remaining 60 are administrative and clerical. The company operates 130 barges but only two barges are needed per month for waste transport. The barges move on all inland waterways, but waste transport activities are confined to the Mississippi River. A 3-compartment, double-hulled tank barge with a capacity of 1400 short tons is used for waste transport. The barges are inspected every two years by the U.S. Coast Guard.

The company has been involved with hazardous waste transport for the past ten years. Several types of chemical wastes are transported to a resource recovery facility in the Houston area.

The activities of a round-trip are as follows: A contract is negotiated between the barge company and the shipper or generator of waste. The company may notify other barge companies to provide tows along the route, if necessary. Once all scheduling has been completed, a barge is fully loaded with chemical waste from a storage tank on the generator's site. A licensed inspector at the dock records the quantity of waste loaded and places a manifest on the barge. The manifest describes the type of material, quantity, origin, and destination. At least two people are involved in the loading and unloading process.

Several towing companies may escort the barge before the final destination is reached. Company crew members will escort the barge from northern Louisiana or a port in Mississippi to the Houston area. There is regular communication between the barge company and the tow crews to maintain a record on the location of the barge. The barge company will notify the harbor terminal ahead of time on the scheduled arrival of the barge. Documentation of the cargo is sent to the receiving terminal by mail. Once the destination is reached, an inspector records the quantity of waste unloaded. The quantity noted should agree with the information on the documents obtained by mail.

The return trip is a carbon copy of the initial trip. The barge is fully reloaded with reprocessed waste, technically a DOT hazardous material. The inspector records the quantity and places the shipping papers on the barge. The barge then travels back to the generator to exchange the reprocessed material for another shipment of hazardous waste.

The company trains all employees involved with boat work.

Records are kept in current files for 9 years and are used primarily for billing and tax purposes.

D. TRANSPORT BY AIR

1. METHOD OF APPROACH

Several different types of sources believed to have knowledge concerning air transport of hazardous waste were contacted (Appendix B-4). These sources included:

(1) Persons knowledgeable in air cargo safety or hazardous materials control at three major airlines involved in both passenger and freight transportation.

(2) Persons knowledgeable in air cargo safety or hazardous materials control at three major freight airlines.

(3) Sources at two small freight airlines.

(4) Three consolidators and/or ground handlers believed to accept hazardous materials.

(5) Two major waste disposal laboratories.

(6) Federal Aviation Administration (FAA).

(7) Four major air transport associations:

- Airline Pilots Association (ALPA);
- Air Transport Association (ATA);
- National Air Transportation Association (NATA);
- Air Freight Forwarders Association (AFFA).

Because the amount of hazardous waste transported by air is quite small, specific industry knowledge about such transport is very limited. Most sources contacted did not have any direct knowledge of hazardous waste transport by air, but could not discount the possibility of small or infrequent shipments such as samples of waste for laboratory analysis. Some sources observed that "all types of CFR Title 49 hazardous materials" have been carried at one time or another, but not necessarily hazardous waste. Each of the three air transport associations, ALPA, ATA, and NATA, have committees or staff members concerned with the transport of hazardous materials and all felt that hazardous waste transport was very limited or nonexistent.

2. FACILITIES AND SERVICES PROVIDED

National carriers, small local and regional airlines, as well as consolidators and ground handlers, can and do accept hazardous waste in limited quantities for transport. Details of air transport facilities were judged not to be relevant to this report.

3. TRANSPORTATION ACTIVITIES

Hazardous waste transport by air is extremely limited due to its expense. Not only is hazardous waste a very small part of the air cargo industry, but the amount of all hazardous materials shipped by air is small. About 4.53 million tons of hazardous materials were shipped by air in 1973,[2a] which represents 0.35 percent of the hazardous materials shipped by all modes (but not including pipeline). Existing practices and regulations in the air transport industry severely limit the quantities of hazardous materials generally that may be packaged and tendered for shipment.

Several instances of hazardous waste transport by air were corroborated and are believed to be representative of the industry. One large freight airline transports about 500 pounds per year of flammable metal shavings, 500 pounds per year of waste nitric acid, and one ton per year of waste radioactive material. This airline carried 7 million pounds of hazardous materials and flew 811 million cargo ton-miles in 1975. The wastes cited were shipped by air because local disposal or treatment facilities were not adequate. (In the case of radioactive materials, they are returned to the manufacturer for disposal.) The wastes are typically relayed from the generator to the airline and from the airline to the disposal facility by truck. Again, on the basis of the concrete response of this airline (one of the larger airlines carrying freight), the total amount of hazardous waste shipped by air is believed to be very small.

Samples of hazardous waste are sometimes air-shipped to disposal facilities for laboratory analysis prior to transporting the bulk wastes for disposal. Such air shipments to the larger disposal facilities amount to a few quart- or pint-size containers per year.

Because air transport of hazardous waste is so limited, many of the details regarding air transportation activities are irrelevant and have been omitted. However, regulations and practices concerning air transport of hazardous materials are described in the next section.

4. REGULATIONS AND PRACTICES

a. Federal Regulations

The existing regulations and standards for the transport of hazardous materials by air are much more stringent than those for other modes. Materials Transportation Bureau, Department of Transportation regulations pertaining specifically to carriage of hazardous materials by aircraft are found in 49 CFR 175. Public Health Service regulations applicable to interstate transportation of etiologic agents are found in 42 CFR 72. Additionally, the Federal Aviation Administration, Department of Transportation administers regulations (14 CFR 1-199) pertaining to aircraft airworthiness standards and maintenance requirements; certification of pilots, flight instructors, flight crew members, air carriers, air taxi operators, etc.; requirements for schools and training programs, which include the handling of hazardous materials and other matters. Safety, in general, is the overriding concern of these FAA regulations.

DOT and FAA regulations also pertain to recordkeeping and training. Copies of shipping papers (waybills) prepared by the shipper must be carried on-board the aircraft. The originating carrier must maintain a copy of the shipping paper for 90 days (49 CFR 175.30). In addition to shipping papers, the air carrier prepares a manifest for the total cargo shipment and the pilot signs acceptance forms (14 CFR 121). Shipments must be labeled according to DOT hazard classes. Sample shipping papers appear in Appendix D.

Airlines customarily follow other recordkeeping practices that are not directly required by regulations. Airlines generally issue a delivery ticket, requiring a signature upon delivery. Shipping papers and delivery tickets are generally retained longer than the 90 days required by regulation. Federal Express, for example, maintains copies of shipping papers and delivery tickets indefinitely but maintains load manifests for 90 days only. For intermodal shipments, shipping papers are certified by shipper even if an agent (e.g., trucker) transports the shipment to the air carrier. If an agent of the consignee accepts delivery, the agent signs for the shipment.

Training procedures must be approved by the FAA and only specially-trained personnel may handle hazardous materials. One large freight airline, for example, provides instructions to pilots for all restricted articles and gives each person handling hazardous materials five days of initial training and another half day every twelve months thereafter.

Although all of the present regulations and practices cited are directed toward hazardous materials generally rather than wastes specifically, there is no recognition of any distinction.

Some differences between practices for air transport and other modes of transport are worth highlighting. The criteria for determining which materials may be shipped by air are more strict than for other modes. Despite this limitation, however, both passengers and hazardous materials can be placed on the same craft (unlike other modes.) The allowable quantities of hazardous materials for air carriage* are considerably smaller than for other modes. Hazardous materials on air flights generally do not require special placarding (unlike other modes), although these materials must be placarded when there is intermodal ground transport.

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*Most are limited to 50 pounds per compartment.

b. Operation STOP[*]

The Airline Pilots Association has promulgated strict standards within Operation STOP--Hazardous Materials Standards and Limitations, with which both freight and passenger airlines comply. The STOP standards place the most severe restrictions on the transport of hazardous materials. In addition to recognizing CFR Title 49 hazardous materials, the Airline Pilots Association has defined "Other Restricted Articles" (ORA) to include any article that "has anesthetic, irritating, noxious, toxic or other characteristics, which can cause extreme annoyance or discomfort to passengers and crew in the event of leakage in flight" (ORA A), or "is a solid material which, when wet, becomes strongly corrosive so as to be capable of causing damage to aircraft structure," (ORA B), or "has other inherent characteristics which make it unsuitable for air carriage, unless properly prepared for shipment" (ORA C). Many such articles may be refused from air shipment and all those accepted must be "properly secured," and with certain exceptions limited to 50 pounds per compartment. The standards are more strict for passenger aircraft than for cargoliners. ALPA is trying to ban restricted articles on passenger craft (except such items as medically necessary radioactive materials with very short half-lives). The latest STOP standards have applied the old passenger craft standards to cargoliners and have further constrained the passenger craft standards. (Such increasingly stringent standards have reduced the amount of hazardous materials shipped by air. Spent nitric acid, for example, is not presently allowed on passenger aircraft.)

For passenger aircraft, the only allowable hazardous materials are certain radioactive materials, dry ice, liquid nitrogen, magnetized materials, and some etiologic agents. For cargoliners, other materials are also allowed, but must be labeled as "cargoliner only" shipments. Flammable liquids, irritants and corrosive materials are restricted to one-quart containers. Container drums of hazardous materials are no longer allowed.

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[*] Safe Transportation of People

All domestic passenger airlines except American Airlines are members of the Airline Pilots Association (but American Airlines claims to follow STOP standards). Many cargo airlines (including Flying Tiger, Airlift International and Seaboard, but not Federal Express) are also members of ALPA. Unfortunately, according to ALPA, STOP standards and DOT regulations are being violated by shippers and cargo managers. ALPA believes more thorough enforcement is necessary.

5. PROBLEM AREAS

Surveillance and enforcement of air regulations is a generally acknowledged problem. DOT acknowledges that the emphasis in the next twenty years in hazardous materials transport by air will be in education, surveillance, and enforcement.[2a] This concern was echoed by several persons in the industry, who noted the enforcement problem. Airline cargo personnel generally do not inspect cargo and are at the mercy of shippers. The Airline Pilots Association has noted that "cargo managers...are tempted to overlook violations of packaging and labeling requirements"[*] and that shippers "are shipping materials through airline cargo receivers who have no idea of their potential for danger." ALPA has documented examples of these violations. DOT has also noted that consolidators and freight-forwarders often do not observe the more stringent requirements of air transport, such as weight limitations and restrictions of certain articles.

It should be noted that Operation STOP was created to protest the continued violation of DOT regulations. In conjunction with the STOP program, a DOT task force[2a] recommended (on March 15, 1975):

- "Serious consideration be given to prohibiting carriage in air commerce of those hazardous materials listed and defined (in the report's appendix)."

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[*] Air Line Pilot, 45, May 1976, pp. 20-29.

- Amendment of the interpretation of "accessibility" of cargo to the flight crew to read as follows: "No person may carry an article requiring a flammable liquid or a flammable gas label aboard a cargo-only aircraft unless the article is loaded in a manner that will allow a crew member in flight unobstructed access to the loaded position."
- Maintenance of DOT regulations on the premises of each air carrier terminal where hazardous materials are accepted.
- Review of training programs by the FAA to insure meeting minimum requirements.
- Clarification of DOT, FAA, and IATA* regulations (regarding hazardous materials).
- Vigorous enforcement of the regulations from shipper and container manufacturer "through the various surface modes to the ultimate final [sic] carrier."

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*International Air Transport Association

E. TRANSPORT BY PIPELINE

1. METHOD OF APPROACH

In general, pipeline transport of hazardous waste in the United States is extremely limited. As a result, the task of determining isolated instances of hazardous waste transport by pipeline was difficult. The approach used was to search available literature and make telephone contacts with as many different types of sources as possible in the hope of discovering instances of pipeline transport.

The information gathering process was dynamic in the sense that initial contacts often provided additional sources of information. Experts knowledgeable about the pipeline industry--the American Petroleum Institute and the Office of Pipeline Safety, Department of Transportation--were contacted first. Subsequent interviews included an officer of a slurry pipeline company, a coal company that formerly operated a slurry pipeline, various pipeline manufacturers, and the Army Corps of Engineers. This initial search indicated that mining operations and coal burning utilities use pipelines for disposal of waste on their own properties. Next officials of copper mining operations, an expert in coal burning utilities, and a company specializing in fly ash (coal waste) and sludge treatment and disposal by pipeline were contacted. Additional information about mining operations was obtained from EPA Region VIII personnel. Several contacts were made with municipal operations that transport sewage sludge via pipeline.

Although difficulties were experienced locating authorities on hazardous waste transport by pipeline, the search was sufficiently thorough, however, to discover relevant operations and reach conclusions concerning the limited extent of this activity. Organizations contacted during the study are listed in Appendix B-5.

2. FACILITIES

The commercial pipeline transport industry in the United States is largely dedicated to the transport of fuel products, especially crude and refined petroleum products and coal slurries. Pipeline companies that transport crude oil or other raw material or product do not carry hazardous waste for several reasons:

(1) Most pipelines are not designed for hazardous waste transport.

(2) It is impractical and uneconomic to transport both types of materials (waste and products), and

(3) Existing pipelines, being stationary, do not ordinarily link hazardous waste generators to treatment, storage, or disposal facilities.

Thus, hazardous waste transport by pipeline is confined to a few concentrated industrial areas in the United States.

There are presently 440,000 miles of major intercity pipelines, none of which are waste lines, carrying 1.9 billion tons of materials per year.[2a] Of these, 265,000 miles are natural gas lines (not including service lines), 103,000 miles are crude oil lines, 68,000 miles are petroleum product lines, 4,050 miles are chemical lines, and 273 miles are coal slurry lines. The chemical lines comprise an 850-mile anhydrous ammonia line, a 1,100-mile liquid ammonia line and a 2,100-mile network for ethylene products. The coal slurry line is the 273-mile Black Mesa pipeline. A 108-mile Ohio coal line has been shut down due to competition from rail and truck.[*] Some 4,300 additional miles of coal slurry lines have been proposed.

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[*] Designs to convert this line to one carrying waste have not been acted upon.

3. TRANSPORTATION ACTIVITIES

Pipelining of waste may be economically attractive where a disposal site is located in the midst of a heavily industrialized area. In three such instances pipeline transport of waste was found, implying that others may exist elsewhere in the United States. At the site operated by William J. Lamberton in Tulsa, Oklahoma, primarily acid waste is pipelined from three galvanizing plants to a central disposal site. At another Tulsa location, two metal-finishing plants share an injection well via pipeline. The Gulf Coast Waste Disposal Authority in Houston and Bayport, Texas, handles pipelined wastewater, although this might be considered industrial discharges which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act. This instance may, therefore, be strictly excluded from RCRA but might nevertheless represent an important consideration to the EPA. Operations similar to these three may exist in other locations. In general, however, the extent of pipeline transport that might be directly regulated by RCRA is severely limited essentially to other heavily industrialized areas in proximity to disposal sites. No large-scale operations were discovered.

Other marginal instances of pipeline waste transport were discovered. Regional sanitary districts sometimes use slurry pipelines for the transport of sludge that may include industrial wastes. Industrial processes, particularly mining operations and coal-burning utilities, use pipelines to transport wastes to dedicated disposal sites, usually on the generators' own property. (For mining operations the waste is often not hazardous.) A brief discussion of the facilities, activities, and practices of these types of operations is presented below.

The most important examples of industrial pipeline activity were found in Oklahoma. William J. Lamberton operates a deep injection well in Tulsa, Oklahoma to which three galvanizing plants transport mostly waste acids by pipeline. The facility receives about 150,000 gallons per month by pipeline and also accepts waste by truck. Most of the pipelined waste is spent sulfuric acid; other wastes include other acids and herbicide rinse water. The companies involved took the initiative in building the system and are the owners of the pipelines which are on the order of 1,000 feet each.

The practices and procedures of the operation differ somewhat from the typical disposal facility. As owners of the pipeline, the galvanizing companies are responsible for maintenance. The Lamberton facility, however, actually performs most of the work. There are about twelve specially trained persons involved in operating the main pipeline. The companies pump their waste on separate days and Lamberton coordinates the scheduling and recordkeeping. All work requests are oral. Formal recordkeeping consists of monthly billings. The billings are based on volumes determined from actual measurements of the pumped wastes.

The Oklahoma Water Resources Board has authority over the operation, but this will soon be taken over by the Oklahoma State Department of Health, Industrial and Solid Waste Management Division. The authority is primarily one of review. The injection well operators report to the Solid Waste Management Division monthly and the generators report annually.

Tulsa, Oklahoma is the location of another instance of hazardous waste transport by pipeline. McDonnell Douglas and Rockwell International share property owned by the Air Force on which they conduct metal finishing operations. A pipeline transports metal finishing waste and rinse water to a holding tank one-half mile away. Rockwell International owns an injection well located next to the holding tank.

A third instance of hazardous waste transport by pipeline is the Gulf Coast Waste Disposal Authority, operating at two sites in Texas. The operation is a quasi-governmental authority whose legal responsibility is questionable should operational problems arise. Much of the waste is industrial wastewater, which may constitute a point source subject to the Federal Water Pollution Control Act. Other wastes accepted include dissolved solids and ammonia, some of which arrives by truck. The regulatory agency for the operation is the State of Texas Water Control Board.

Some public sanitary authorities also transport hazardous waste by pipeline. It is not clear whether these situations are impacted by Section 3003 of the RCRA. The Cleveland Regional Sewer Authority, for example, has a 14-mile pipeline in which primary sludges and excess activated sludge from domestic sewage is pumped from one treatment station to another. The Metropolitan Sanitary District of Greater Chicago uses sewage sludge to reclaim land 200 miles from the city. Sludge is pumped from one treatment facility through a 30-mile pipeline to another facility where it is treated and barged to the reclamation area. Recordkeeping is performed on a monthly basis by an outside consultant. There is no additional shipping document for the barging part of the operation.

Both sludge operations have small operational crews and are run as normal pipelines. One other public authority of interest is the Los Angeles County Office of Sanitation which accepts applications for disposal of industrial waste within the county sewer system.

Several instances were identified of generator pipeline transport and disposal on-site of flue dust (from coal-burning utilities) and mining wastes. This leads to the conjecture that there may be instances of pipeline transport of similar wastes off-site, although none were discovered.

4. REGULATORY CONTROL AND PRACTICES

The pipeline transport of gases and liquids is generally governed by 49 CFR 190-199. Part 195 pertains specifically to liquids and applies only to the transportation by pipeline in interstate and foreign commerce of hazardous materials that are subject to 49 CFR 172-173, petroleum, and petroleum products. Whenever a hazardous material is to be transported, the Secretary of the DOT must be appropriately notified in writing. Accidents must be reported to the Director, Office of Pipeline Safety. Additionally, municipal operations often need local disposal permits. For the examples previously cited, state authorities have limited regulatory jurisdiction. Finally, uncertainty exists whether the Federal

Water Pollution Control Act applies to the pipelining of wastewater. In summary, the regulatory basis for hazardous waste transport by pipeline is not altogether clear. The situation is further complicated by the paucity of standards for pipeline operations.

IV. OFF-SITE TRANSPORT BY GENERATORS

A. METHOD OF APPROACH

The objective of the work reported in this section is to examine and characterize generators acting as private carriers that transport hazardous waste off-premises in their own vehicles to hazardous waste management facilities (treatment, storage, and disposal). In order to obtain an estimate of the number of generators self-hauling to off-site facilities and the fraction of hazardous wastes self-hauled, the 14 EPA Industry Studies[3-16] were reviewed and telephone contact was made with the Principal Investigator for each Industry Study. It was found that 3.5 percent of the plants inventoried as part of the industry studies transported their own wastes, and that less than 3 percent of the total quantity of waste hauled off-site was transported by the generator. Thus, a survey of 100 plants selected at random would be expected to identify at most four that hauled their own wastes. It was therefore not possible within the scope of work of this study to obtain a representative sample of plants that self-haul.

A list of 54 plants likely to transport their own wastes was compiled from information supplied by the Principal Investigators of each of the Industry Studies, information obtained in other parts of this study, and information available from prior industrial work by Arthur D. Little, Inc. The plant manager at each of the plants identified was contacted by telephone. Twenty-seven contacts were made with large firms (over 100 employees), and twenty-seven were made with small firms (20 to 50 employees). Most of the contacts were with plants falling within the SIC codes covered by the EPA Industry Studies. Transport was not specifically included in the scope of work of the industry studies, and in fact very little transportation information was gathered by the EPA contractors. In particular, the universe of plants that self-haul is not known. Hence, there is no basis for statistically valid sampling of plants for personal interview. Nonetheless, the interview data that were obtained showed a generally consistent pattern.

The type of information sought during the interviews included:

- nature of the wastes self-hauled
- quantity of waste in a single haul
- source of waste in a single haul—waste from one process, several processes, one plant, several plants
- number of hauls per year
- kind of transport vehicle used; age; useful lifetime
- procedure for loading and unloading wastes
- crew size
- placarding and labeling
- record keeping
- distance hauled
- final destination
- accidents, other than traffic violations.

The specific data obtained is summarized in the text. In general, there was a marked contrast between small and large firms in willingness to discuss hazardous waste transport. When hazardous wastes were defined as wastes likely to come under RCRA regulations, large firms understood immediately, although many did resent the designation "hazardous." Small firms either professed ignorance of RCRA, or flatly refused to discuss the subject of waste transport at all.

Small firms, taken in the aggregate, probably generate significant quantities of waste, even though the quantity generated by any given business may be minor. Because of the low volume of wastes generated (one or two 55-gallon drums per month), a small firm may be more likely than a large one in the same industry to use its own trucks to haul wastes offsite. It may in fact be difficult to find a permitted contractor to handle a small quantity of waste. On the other hand, where the quantity of chemical wastes is small, there may be a tendency to discard them with municipal trash, pour them down the sewer, dump them on an unused portion of the property, or keep them around in storage.

B. INDUSTRIES THAT SELF-HAUL

1. Industry and Geographic Distribution

Table IV-1 provides approximate figures for the quantities of hazardous wastes transported off-site from industries that have been studied under the 14 EPA/Hazardous Waste Management Division contracts. The number of plants in each industry disposing off-site and using self-haul, HWMF/transporters[*], and for-hire common and contract carriers were extrapolated to the entire industry, based on data obtained by industry study contractors in a limited sampling of plants. The quantity of waste transported by the generators (Q) was calculated as the total quantity of waste hauled off-site (W), multiplied by the ratio of the number of plants self-hauling (S) to the total number of plants whose waste was transported off-site[**] (N), i.e.,

$$Q = W \times (S/N) \qquad (1)$$

This relationship assumes that every plant is the same size, corresponding to the approach used in the industry studies. Insofar as it is the smaller plants that self-haul, the estimates of total quantity of wastes transported by generators will be somewhat high.

For the industries in Table IV-1, 3.5 percent of the plants surveyed self-haul some or all of their hazardous waste to an off-site disposal facility. More than 10 percent of the waste oil re-refining, leather tanning, and paint plants self-haul. Between 2 and 5 percent of the plants in the textile, special machinery, and pharmaceutical industries self-haul. Less than 1 percent of the plants in other industries self-haul.

Approximately 19 percent of the total processing waste generated by the industries listed in Table IV-1 is hauled off-site. Only 2-3 percent of the total hauled off-site (0.4 percent of the total generated)

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[*] Firms operating hazardous waste management facilities acting as contract or private carriers.

[**] As opposed to on-site treatment, storage, or disposal.

TABLE IV-1

SOURCES OF HAZARDOUS WASTE TRANSPORTED OFF-SITE

	Number of Plants						Hazardous Waste[a]			
									Self-Hauled Off-Site	
	SIC Code	Total	Using Off-Site Facility (N)	Self-Haul (S)	Using For-Hire Transport	HWMF/ Transporter	Total Generated	Transported Off-Site (W)	Quantity (Q)	As Percentage Of Total Off-Site (100 Q/W)
Textiles[b]	22XX	5366	5366	268	1878	3220	1,878,000	103,000[b]	5140	5
Inorganic Chemicals	281X	900	225	1	--	224	3,782,000	567,000	2520	0.4
Pharmaceuticals[b]	283X	219	219	6	82	131	73,000	62,050	1700	3
Paints & Coatings[b]	285X	372	372	37	112	223	147,000	139,450[b]	13,900	10
Organic Chemicals, Pesticides, & Explosives	2869, 2879, 2893	899	899	5	0	894	6,492,000	1,300,000[b]	7230	0.6
Petroleum Refining	291X	247	247	?	?	?	1,406,000	844,000[b]	?	?
Rubber & Plastics	30XX									
Leather Tanning & Finishing	3111	298	298	81	217	0	173,000	164,350[b]	45,700	27
Primary & Secondary Metal Smelting and Refining	33XX	2690	108	0	108	0	17,566,000	351,000	0	0
Electroplating & Metal Finishing	3471	197	130	1	129	0	4,053,000	2,837,000	21.800	0.8
Special Industry Machinery	355X	5684	5400	270	5130	0	153,000	145,000	7230	5
Office, Computing & Accounting Machines	357X									
Electronic Components	367X	2855	2483	25	2458	0	64,000	55,700	560	1
Storage & Primary Batteries	3691-2	263	92	1	--	91	543,000	353,000	3840	1
Waste Oil Re-refining	5093	27	19	10	0	9	74,000	55,000	28,900	53
Totals		20,017	15,858	705	10,114	4,792	37,349,000	6,977,000	138,000	2.3[c]

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[a] Wet metric tons per year

[b] All firms dispose of some of their wastes off-site, but they also have on-site facilities for disposal of other wastes.

[c] Excluding Petroleum Refining industry.

SOURCE: References 3-16

is transported by the generator in company-operated vehicles.

At least one plant in every industry in Table IV-1, except for metal smelting and refining and petroleum refining, that self-hauls was identified and contacted in this study. Metal smelting and refining generates large quantities of hazardous waste, most of which are handled on-site. Petroleum refining is also a large generating sector, with a large quantity of waste per average plant; whereas some wastes are handled on-site, most wastes are handled by contractor services.

2. Fleet Size

Most self-haulers operate only one waste transport motor vehicle, which in some cases is not even dedicated to this activity. The vehicle is usually operated by a single driver employed by the plant. He may be assisted in loading by plant personnel and in unloading by disposal site personnel. The few generators that self-haul own the transport vehicles used, and engage solely in motor carriage.*

3. Services Provided

Plants that self-haul handle only their own wastes. No industrial waste generator was found that offers waste transport services to other companies. Only one company was identified which provided general waste transport services for a number of their own plants. The decision to self-haul or to use a contractor is generally made at the plant level.

Wastes that are self-hauled are generally transported as generated, without treatment. They are usually taken to a company-owned landfill, or lagoon, and occasionally to a municipal or private landfill. No instance was discovered in which the waste was self-hauled to resource recovery facilities, although this should not be ruled out.

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*Some generators own rail tank cars and/or tank barges that are used to transport wastes, but the actual transport is not done by the generator. This case does not fall into the category of "self-hauling."

C. TRANSPORTATION ACTIVITIES

1. Extent of Services

As indicated previously, it is estimated that fewer than four plants out of a hundred haul their own waste to off-site disposal facilities. Even with a pre-selected list of companies believed to transport their own wastes, the majority of the 54 plants contacted were found to be using HWMF/transporters or for-hire common and contract carriers. The limited data obtained suggest that self-hauling firms tend to be the smaller firms in an industry, and tend to be located in rural areas where external transport services are not available. Wastes transported by plants are usually hauled a distance of less than 10 miles, and often are hauled no more than 1-2 miles.

The following is a summary of the extent of self-transport services by industry. The types of vehicles used, containerization practices, personnel, prenotification/acceptance, routing/dispatching, loading/unloading, delivery to disposal site, handling of spills, and marking and labeling are discussed in subsequent sections.

a. Textile Industry, SIC 22XX

As part of the EPA Industry Study,[10] visits were made to 80 plants, representing 16 percent of the production capacity of this industry. While all plants visited used off-site disposal facilities for some of their wastes, only four plants (5 percent) were identified as self-haulers. In every case wastes were trucked to a landfill located no more than 10 miles from the plant site.

b. Pharmaceutical Industry, SIC 283X

One firm was identified as self-hauling. The firm has three plants located within a 100-mile radius. Self-hauling is primarily from the two older plants to the newest one. The latter is seven or eight years old, and was designed to permit maximum recycling and heat recovery incineration. Contract waste haulers are also used, particularly for spent chemicals.

c. Paints and Coatings, SIC 285X

The EPA Industry Study[4] states that 10 percent of the plants visited haul wastes to landfills in their own trucks. The Principal Investigator recalled that there were many self-haulers in the Baltimore, MD, and Dallas-Fort Worth, TX areas. Sludges or paint wastes were typically loaded into 55-gallon drums and hauled a distance of less than 10 miles to a landfill in open dump trucks together with municipal trash.

d. Organic Chemicals, Pesticides, and Explosives, SIC 2869, 2879, 2892

These industries typically dispose of their hazardous wastes either on-site or through contract waste haulers. Fourteen major chemical companies were identified as possibly self-hauling based on information obtained from the EPA Industry Study[7] or contained in Arthur D. Little, Inc. files. Telephone contact with environmental directors in nine of these companies did not yield any instances of generators that self-hauled. A petroleum refining company was identified, however, that has a chemicals group with plants in Lake Charles, LA, and Baltimore, MD. These plants occasionally haul drums of spent catalyst and caustic in a stake-body, flat-bed truck to municipal landfills. Approximately 15-20 drums are transported about once a year over a distance of at most 10 miles.

e. Leather Tanning and Finishing, SIC 3111

The EPA Industry Study[13] stated that some plants, among the 41 visited, did haul their own wastes. The type of waste self-hauled, according to the Principal Investigator of that study, is leather scraps in some stage of processing. Open dump trucks are used for transporting the wastes, which are considered hazardous due to the chromium content of the partially-processed hides. Typically, the distance hauled is about two miles to a municipal dump.

f. Asbestos Products, SIC 3292

A company was contacted that manufactured asbestos products at six locations. One plant out of the six transported their own wastes. The other five used on-site disposal. The self-hauling plant, located in New Jersey, transports asbestos pipe scrap and settling basin wet solids in a dump truck less than one mile to a landfill.

g. Electroplating and Metal Finishing, SIC 3471

The EPA Industry Study[3] identified one firm out of 33 visited that used its own trucks to haul wastewater treatment sludges, and one job shop out of nine visited that used its own trucks to haul solid waste. A captive plating plant in Pennsylvania was contacted. The plant self-hauls alkaline mixed metal hydroxide sludges to a company-owned lagoon two miles from the plant site.

h. Special Industry Machinery and Office, Computing, and Accounting Machines, SIC 355X, 357X

According to the EPA Industry Study[5] one company out of 33 visited trucked its own wastes to a landfill. Since the study files appear to be unavailable, no further details could be obtained. A Massachusetts machining company was contacted that does haul its own wastes. Metal sludges and oil-contaminated grindings are transported in company-owned trucks over a distance of about 5 miles to a certified landfill.

i. Electronic Components, SIC 367X

The EPA Industry Study[16] cited one case of a plant using its own trucks to haul to landfill. The Principal Investigator identified the plant as a large TV manufacturer in the Northeast. The wastes hauled were lead-containing sludges. They were transported a distance of less than one mile to a company-owned disposal lagoon. Due to a confidentiality agreement, no further information could be supplied.

j. Storage and Primary Batteries, SIC 3691, 3692

The EPA Industry Study[8] stated that 80 percent of the plants visited use contract or municipal waste haulers to transport wastes to off-site facilities; 20 percent treat and dispose of their own wastes. The Principal Investigator recalled that all lead-acid battery wastes were treated on-site at these facilities by neutralization/recovery of $Pb(OH)_2$. Scrap batteries, frequently mixed with trash, are nearly always transported by municipal haulers to segregated landfills.

Contact was made with one company identified as possibly hauling their own wastes. Many of the company plants are located in small towns. At these plants, company-owned and operated two-ton multi-service trucks are used to haul scrap batteries together with general trash to municipal dump sites. Haul distances are generally less than 10 miles.

k. Waste Oil Re-refining, SIC 5093

The EPA Industry Study[15] found 10 re-refiners, out of 27 visited, that hauled untreated clay wastes in their own trucks. The self-haulers tend to be the smaller companies. The three largest re-refiners use contract waste haulers.

2. Types of Vehicles

The transport vehicles used by generators who self-haul range from general purpose stake-body, flat-bed and dump trucks to 5,000-gallon tank trucks. Table IV-2 summarizes by industry the types of vehicles used for various kinds of wastes, and the range of vehicle utilization. Illustrations of various types of trucks appear in Appendix C. Most self-haulers own and operate a single dump truck dedicated to the transport of wastes. In battery plants, a non-dedicated multiservice truck is often used. Dump trucks are typically over 10 years of age, which plants claim to have made "leak-proof" and covered within the last year or two. The average age of tank trucks is 6-8 years.

3. Containerization Practices

When waste is transported by tank truck, the vehicle itself of course serves as the container. When a dump truck is used, wastes may simply be deposited loose along with municipal trash. More often, however, the wastes are loaded into the truck in trash barrels or in 55-gallon drums. Even when wastes are transported by a contractor, the generator typically supplies the containers (usually barrels for dry wastes and drums for liquids or sludges). Several specific examples are given below.

A leather tannery in Maine operating its own open-top dump truck, hauls chemically-contaminated leather scraps in barrels. An asbestos products manufacturer hauls settling basin wastes in a dedicated "leak-proof" covered dump truck which serves as its own container. Baghouse wastes, however, are put into marked plastic bags. A small electroplating plant, using a contract hauler, loads the equivalent of six barrels per week of floor sweepings from a polishing and buffing shop uncontainerized into the contractor's dumpster bin. A special machinery plant loads a mixture of metal sludges and oil contaminated grindings loose into dump trucks. A capacitor manufacturer, using a HWMF/transporter, transports PCB-saturated Fuller's earth filter media in 40-gallon fiber drums with polyethylene linings. In the battery industry, liquid wastes (cell washings) are generally hauled in drums by HWMF/transporters. Scrap batteries are transported loose with municipal

TABLE IV-2

TYPES OF VEHICLES USED BY GENERATORS WHO SELF-HAUL WASTES

Industry	SIC No.	Type of Waste	Type of Vehicle	Typical No. of Vehicles per Plant	Utilization Rate
Textiles	22XX	Nylon and cotton scrap	Dump Truck	1	2 hauls/week
Pharmaceuticals	283X	Treatment-plant sludge (30 percent solids)	Tank Truck	2 (larger is 5000 gal.)	25-30 hauls/week/truck
		Dry solids	Dump truck with tarp cover	25-50	"
Paints & Coatings	285X	Sludges and paint with municipal trash	Dump truck	1	4 hauls/week
Leather Tanning & Finishing	3111	Chrome-contaminated leather scrap	Dump truck	1	1 haul/day
		Sludge (3 percent solids)	2000-gal. tank truck	5	1 haul/day/truck
Asbestos Products	3292	Asbestos scrap, baghouse wastes, and settling basin sludge	Dump truck (leak-proof)	1	1 haul/day
Electroplating & Metal Finishing	3471	Sludge	1500-gal. tank truck	1	6 hauls/day
Special Machinery, Office Machines	355X, 357X	Metal sludges, oil-contaminated grindings	Dump truck	1	1 haul/day
		PCB-saturated Fuller's earth	Semi-trailer truck	2	1 haul/month/trailer
Storage & Primary Batteries	3691,2	Scrap batteries	2-ton dump truck (covered & leak-proof)	1	1 haul/day
Waste Oil Re-refining	5093	Tarry sludges	4000-gal. tank truck	1	1-2 hauls/week

Source: Arthur D. Little, Inc., based on industry survey.

trash by some rural plants. A major paint company stores solvent-containing oil, waste paint, and sludge in company-supplied metal drums, which are picked up by a contractor and hauled in stake-body, flat-bed trucks. Most chemical companies contacted use waste haulers, but have the wastes picked up in company-supplied 55-gallon drums. The Department of Defense (DOD), which uses contractors for all waste hauling and dispoal, also supplies containers. Frequently DOD uses Sea/Land Semi-Trailers, and loads these with 55-gallon drums of waste, which are put on container ships. DOD also uses CONEX containers, which contractors must bring back. (CONEX containers were developed during the Korean conflict for transport of supplies.)

4. Personnel

In situations where the generator is also a transporter, wastes are typically hauled by a single driver, who often assists with loading and unloading. The driver is an employee of the plant and is trained in both safe handling of the wastes and vehicle safety. When several trips to the disposal area are made each day, as many as four or five persons from the various shifts may serve as back-ups to the regular driver.

5. Routing/Dispatching

Trucks are filled from storage and dispatched when loaded. They are generally routed via the most direct pathway to their final destination. In most plants, wastes are usually transported during normal working hours, but infrequently they may be transported by shift personnel as well.

6. Loading/Unloading

Company personnel are nearly always involved in loading, often (but not always) with assistance from the driver of the vehicle, regardless of whether the driver is a company or contractor employee. When the driver is a company employee (self-hauling situation), the driver is nearly always involved in unloading, with assistance from landfill personnel. The reason is that self-hauled wastes are often transported to a small landfill or lagoon owned by the company and dedicated to its own wastes. A given vehicle, in a single haul, will normally be carrying only wastes from one plant and will go directly from the plant to the landfill with no intermediate stops.

Tank trucks are frequently gravity-fed from a storage tank seated on a platform. In some cases still bottoms or sludges may be pumped from a holding tank or 55-gallon drums into the tank truck. In one case (a waste oil re-refiner), tarry sludges are loaded into a tanker via an above-ground pipeline. Tank trucks are usually unloaded by gravity through a four-inch valve at the rear of the vehicle, directly into a landfill or lagoon.

Wastes transported loose in dump or stake-body, flat-bed trucks may be loaded into the truck from a wheelbarrow, and unloaded directly into the landfill area by dumping. Barrels and drums are usually loaded onto flat-beds via a forklift truck operated by company personnel (or the driver in the case of self-haulers).

7. Delivery to Disposal Site

Wastes hauled by generators are typically taken either to a site owned and operated by the company and dedicated to the wastes in question, or to a general purpose municipal or private landfill. When delivery is to a company-owned and operated site, company personnel accept the wastes and assist in unloading them, usually directly into a landfill or lagoon. There is typically no testing, inspection or paper work at the disposal site.

When the final destination is a municipal or private landfill, prior arrangements are made to ensure that the landfill is permitted for the wastes in question, and that the landfill is operated in accordance with regulations. Such regulations might encompass times that wastes can be delivered, signing in at an office or weighing station, and disposing at a designated working face. Trucks submit a copy of the bill of lading to the landfill operator for billing purposes. The quantity of waste delivered is recorded either by weighing or by a volume estimate, and the truck is directed to a dumping area. Typically, no inspection or testing is done at the landfill site.

8. Marking, Labeling, and Placarding

Marking and labeling practice varies a great deal. Many firms do not placard their trucks carrying hazardous waste. Many companies said they followed DOT marking and labeling requirements, but most admitted that application of DOT requirements to hazardous wastes (as opposed to hazardous materials) was not entirely unambiguous. A number of specific examples are discussed below.*

In the chemical industry, the companies typically assume responsibility for labeling, whether they self-haul or use contractors. Several major companies had developed labeling systems of their own. These vary from stencilling drums with yellow permanent markers and the DOT triangle, to fairly elaborate statements of the type of wastes, warning, disposal procedures to be used, etc. All companies look forward to some clear and effective labeling guidelines for waste materials.

A large inorganic chemicals manufacturer in Louisiana uses outside contractors to haul sodium/calcium sludge wastes by truck, rail car, and barge. Appropriate DOT labels and placards are used on rail cars and trucks. A pharmaceutical manufacturer engaged in self-hauling does not placard its trucks and labels drummed wastes only with a large red dot indicating "to be destroyed." A vegetable tanning firm in Georgia self-hauls sludge containing 3-4 percent solids in 2000-gallon company-owned and operated tank trucks. The sludge is sold for pasture fortification. Trucks are not placarded in any way.

An electroplating plant self-hauling fluid sludge wastes does not placard its tank truck. A manufacturer of special machinery hauls loose sludge and grinding wastes in an unplacarded truck. A capacitor manufacturer uses a HWMF/transporter to convey PCB-saturated Fuller's earth in fiber drums. The drums are labeled in accordance with DOT standards; however, the trucks into which the drums are loaded are unplacarded.

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* In these examples the wastes described may or may not be hazardous materials in interstate commerce. If they are not, DOT marking, labeling, and placarding requirements are not applicable.

9. Handling of Spilled Materials

Very few of the firms contacted could recall any actual accidental spills or incidents. Chemical industry plants generally seem to have a spill response procedure in place. Other industry plants often do not.

One accident reported by a chemical plant involved a local resident who took a drum from a disposal site illegally. The drum exploded when it was opened and the resident lost a leg. Damages were apparently paid by the company rather than the disposal facility, despite the fact that the contractor had legal possession of the waste. Another accident was reported by an electroplating plant self-hauling sludge wastes by tank truck. The truck was struck by another vehicle and overturned on the road. A modest attempt was made to recover the spilled waste, and apparently there were no damages. The Department of Defense could recall only one waste transport accident occurring in the past twenty years. A PCB container ruptured as it was being unloaded from a ship onto a dock. A crane knocked the container against the side of the ship. The Corps of Engineers vacuumed the entire bottom of the channel to remove the PCB's. The recovered material was placed in a secure landfill. Clean-up costs were about $750,000.

Generally, if an accident occurs on the road an "environmental affairs" group within the company is supposed to be notified, and procedures have been established to dispatch a clean-up crew.

D. BUSINESS/ADMINISTRATIVE PRACTICES

1. Shipping Documents

Generators, at least the major companies, do keep records of how much waste is shipped, who carried it and where it went. Such records are usually kept for a period of at least seven years (common business practice in part inspired by Internal Revenue Service considerations). Self-haulers transporting to a company-owned site typically prepare a summary report monthly on the quantity of material hauled.

2. Billing Procedures, Charges, and Contract Negotiations

Generators that self-haul off-site to their own property do not generally account separately for the costs of waste transport and disposal.

Decisions with respect to contracting for waste transport and disposal are usually made by the plant manager at each location. In general, a plant manager will require three bids before letting a contract, but many locations do not have a choice of three contractors. Contracts are typically signed on an annual basis. Landfills are purportedly investigated by the plant to make sure that they are approved for the wastes in question. The contracting agreement generally provides for the contractor to take possession of the wastes on leaving the generator's property.

A vegetable tannery which sells its sludge wastes for pasture fortification passes on the costs of transport to the purchasers. Although in this case the generator hauls, the records show the purchaser as the transporter.

3. On-Site Storage

Storage practice varies a great deal--from the electroplating plant that self-hauls its sludges six times a day and therefore stores in a holding tank on the average of four hours, to the resin plant that currently has phenol wastes in "temporary" storage on-site "pending the development of an adequate disposal method." Most plants fall somewhere in between, storing for periods ranging from weeks to months. A summary of information obtained by industry is given in Table IV-3. No instance was discovered of hazardous waste storage in company-owned vehicles.

TABLE IV-3

STORAGE PRACTICE IN SELECTED INDUSTRY SITUATIONS[a]

Industry	SIC No.	Type of Waste	Storage Mode	Storage Time
Textiles	22XX	Nylon and cotton scrap	Drums	2-3 days
Pesticides	2879	Rinsed and crushed 5-gallon metal insecticide containers	Bin	3 months
Inorganic Chemicals	281X	Sodium/calcium sludge	Drums	1 month
Pharmaceuticals	283X	Radioactive material	Packed in drums with vermiculite	3-4 months
Pharmaceuticals	283X	Liquids	Holding tank (contractor-supplied)	3-7 days
Paints & Coatings	285X	Emulsion sludge from tank washings - 18% solids, 82% water	Holding tank	1-2 days
Electroplating & Metal Finishing	3471	Plating sludges	Holding tank	4 hours
		Spent liquid PCB's	55-gallon drums	5-10 days
Waste Oil Re-refining	5093	Tarry sludge	Holding tank	3-7 days
Waste Oil Re-refining	5093	Oil soaked in earth (filter medium)	Contractor supplied containers	5 days

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[a] Not during transport.

Source: Arthur D. Little, Inc., based on industry survey.

4. Driver Training/Licensing

Drivers of generator-owned and operated vehicles are company employees, all of whom generally receive safety training. With the promulgation of the new DOT regulations for transport of hazardous materials, most major companies have stepped up their safety and driver training programs.

5. Safety Practices

Apart from trying to understand and follow DOT regulations, most companies did not seem to have a strong, affirmative safety program in place. Diking of storage tanks, for example, is more the exception than the rule. Many trucks are not covered, and many have only recently been made "leak proof."

6. Vehicle Maintenance

Major companies not only inspect their own transport vehicles, but also do not permit contractor vehicles to leave the premises until they have been inspected.

7. Regulations Followed

Everyone claims to follow DOT regulations. Many generators claim to follow state regulations as well. A New Jersey paint plant, for example, claimed to use a permitted hauler and a permitted landfill as required by the State. A Massachusetts manufacturer of special machinery claims to have a hazardous waste transporter's license from the State to self-haul. An asbestos manufacturer claimed to adhere to EPA air quality regulations prohibiting visible emissions during transfer, transport and disposal operations.

E. REGULATORY CONTROL

As previously discussed in Section III.B.5, the DOT administers Federal regulations pertaining to interstate transport of hazardous materials by public highway, including motor vehicle safety. Furthermore, many states have adopted these regulations, or portions thereof, for intrastate transport of hazardous materials. The foregoing regulations apply to generators that self-haul hazardous wastes which meet the definition of hazardous materials. Generally speaking, it is uncommon for generators that self-haul to cross state lines.

All generators that self-haul (excluding transport companies that become generators when cleaning their tank trucks, etc.) are ICC-exempt as private carriers.

V. TRANSPORT BY OPERATORS OF HAZARDOUS WASTE MANAGEMENT FACILITIES

A. METHOD OF APPROACH

This section characterizes the transport of hazardous waste by firms also operating hazardous waste management facilities (treatment, storage, and disposal) acting as contract or private carriers. These carriers convey (invariably by truck) hazardous waste from the generator's premises to the place of treatment, storage, or disposal. To avoid needless duplication this section does not repeat those aspects which HWMF/transporters* have in common with for-hire motor carriers discussed previously.

From the EPA publication "Hazardous Waste Management Facilities in the United States - 1977",** which lists approximately 110 hazardous waste management facilities, about 60 were initially selected. These were described in the publication as being involved in transportation and therefore became candidates for interviews. At the same time, cognizant agencies of several state governments were contacted either to develop background information on the selected facilities or to identify other potential interview candidates. The information on which this section is based was obtained through telephone and in-person interviews with HWMF/transporters and through perusals of state agency files. Helpful general discussions were held with the National Solid Waste Management Association and the National Center for Resource Recovery, but these did not yield pertinent data compilations on HWMF/transporters or suggested transporter contacts.

A total of 75 contacts were made with firms initially identified as HWMF/transporters, as summarized below:

Related and responding	54
Not directly related	21
Not responding	11
Total	86

Information sources are listed in Appendix B-7.

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*Hazardous waste management facility/transporters.

**EPA/530/SW-146.3, January 1977.

Of these, 7 firms operated hazardous waste management facilities but did not transport, and 14 firms transported hazardous waste but did not operate hazardous waste management facilities. (Many firms identified initially as HWMF/transporters in actuality provide either hazardous waste management or transport services, but not both; however, they frequently have working agreements with other companies providing the complementary service. In many cases, the generator contracting with these firms is unaware of and disinterested in these private arrangements.)

B. FACILITIES AND SERVICES PROVIDED

1. Geographic Region Served

According to the EPA publication "Hazardous Waste Management Facilities in the United States - 1977", 67 percent or 74 of the listed hazardous waste management facilities are also transporters. The majority (56 percent) of the listed HWMF/transporters are located in EPA Regions II and V[*] with 35 percent in Region V alone. Region IX (California), which has the largest number (13) of facilities identified, has relatively few (4) which are engaged in transportation.

The location and distribution of facilities from which information has been obtained is shown in Table V-1. Information was obtained either directly from the facilities or indirectly through state agencies. It should be noted that not all of the 54 facilities from which information was obtained provided complete information sets. Therefore, the discussions and tables which follow do not necessarily include all facilities.

Sixty-four percent of the surveyed facilities transport hazardous waste interstate. Further, 56 percent of the firms have facilities in more than one state or are receiving hazardous waste from outside the state. Thus, many of the HWMF/transporters are subject to regulations of multiple jurisdictions including those of Federal agencies.

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[*] Region II includes New York and New Jersey, and Region V includes Minnesota, Wisconsin, Illinois, Indiana, Ohio, and Michigan.

TABLE V-1

DISTRIBUTION OF HWMF/TRANSPORTERS SUPPLYING INFORMATION

EPA Region	State	Number of HWMF/Transporters
I	Connecticut	1
	Massachusetts	1
II	New Jersey	2
	New York	2
V	Illinois	1
	Indiana	4
	Michigan[a]	27
	Ohio	6
VI	Arkansas	1
	Oklahoma	1
	Texas	3
IX	California	4
X	Washington	1
	Total	54

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[a] The large number of facilities in Michigan resulted from access to the registration/certification files of the state's Water Control Division of the Environmental Protection Branch, Department of Natural Resources.

2. Ownership

With the exception of a few very large companies, most HWMF/transporters surveyed are privately owned or closely held public corporations. Although a few firms were willing to discuss the financial implications of the pending regulations, the private ownership factor has mitigated against obtaining financially-related information concerning transportation.

3. Fleet Size and Number of Employees

Whether expressed in terms of number of motor vehicles* or number of employees involved in transportation, the HWMF/transporters included in the investigation are relatively small; 74 percent operate ten or fewer vehicles and at least 66 percent have ten or fewer employees. Tables V-2 and V-3 give size distributions for the approximately 50 firms from which data were obtained.

C. TRANSPORTATION ACTIVITIES

1. Extent of Services

As indicated previously, most of the HWMF/transporters surveyed convey hazardous waste both interstate and intrastate, but the total quantity transported annually is unknown.

Those HWMF/transporters who operate only intrastate tend to serve in a relatively small (say, less than 100-mile radius) geographical area or section of the state. Those who operate interstate generally serve within a region rather than operating interregionally—for instance, within the heavily industrialized portion of the Midwest including the states of Illinois, Indiana, Michigan, and Ohio. The split between interstate and intrastate operators is unknown in terms of quantity of waste hauled nor is it known what fraction of an interstate operator's business is done outside his home state.

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*Vehicles used exclusively within the hazardous waste management facility itself are of no concern in this chapter.

TABLE V-2

NUMBER OF MOTOR VEHICLES OPERATED BY HWMF/TRANSPORTERS

Number of Vehicles	Percent of Firms Including[a] Michigan Data (N = 50)	Percent of Firms Excluding[a] Michigan Data (N = 22)
1-2	12	14
3-5	28	18
6-10	34	32
11-15	14	18
16-20	8	9
21-30	0	0
Over 30	4[b]	9[b]
Total	100	100

Source: Arthur D. Little, Inc., estimates.

[a] The differentiation being made results from the fact that the data are dominated by those from Michigan.

[b] The largest number of vehicles was 100; the second largest was 50.

TABLE V-3

NUMBER OF HWMF/TRANSPORTER EMPLOYEES INVOLVED IN TRANSPORTATION

Number of Employees	Percent of Firms Including[a] Michigan Data (N = 52)	Percent of Firms Excluding[a] Michigan Data (N = 24)
1-5	38	29
6-10	36	38
11-15	10	8
16-20	6	4
21-25	2	4
Over 25	8	17
Total	100	100

Source: Arthur D. Little, Inc., estimates.

[a] The differentiation being made results from the fact that the data are dominated by those from Michigan. Because employee counts for the several facilities in Michigan were unavailable, an assumption was made that there was one employee for each vehicle in that state. This assumption appears to be reasonable in light of interviews conducted with other HMWF/transporters in this study.

2. Age and Types of Vehicles

HWMF/transporters use motor vehicles that average between 9 and 12 years of age; the range is from brand new to over 20 years. Table V-4 shows two distributions of the age of vehicles. The first distribution includes all vehicles for all firms. The second is restricted to data obtained from firms in Michigan; these data may be more representative of the actual nation-wide population in that they were obtained from each of the 27 HWMF/transporters in Michigan (i.e., a complete sample). Moreover, of the 116 vehicles in the "All Firms" column whose age is five years or less, 50 vehicles are from a single company.

TABLE V-4

MOTOR VEHICLE AGE DISTRIBUTION FOR HWMF/TRANSPORTERS

Age in Years	All Firms		Firms in Michigan Only	
	No. of Vehicles	Percent	No. of Vehicles	Percent
1-5	116	39	28	15
6-10	61	21	51	27
11-15	50	17	42	22
16-20	39	13	39	20
Over 20	31	10	31	16
Total	297	100	191	100
	Mean = 9 years		Mean = 12 years	

Source: Arthur D. Little, Inc., estimates.

As seen in Table V-5, tankers and tank trailers predominate in terms of types of motor vehicles used. There are some flatbeds and vans; these represent less than 30 percent of vehicles used. Illustrations of various types of trucks appear in Appendix C. No instances of barges or rail tank cars provided by HWMF/transporters were discovered.

TABLE V-5

DISTRIBUTION OF MOTOR VEHICLE TYPES FOR HWMF/TRANSPORTERS

Type of Vehicle	All Firms		Firms in Michigan Only	
	No. of Vehicles	Percent	No. of Vehicles	Percent
Tankers	191	60	113	58
Tank Trailers	43	13	35	18
Stake-body, flat-beds	56	18	17	9
Vans	30	9	29	15
Dump Trucks	1	0	1	0
Total	321[a]	100	195[a]	100

[a] The difference in vehicle counts between Tables V-4 and V-5 is due to the unavailability of ages for all the vehicles.

Source: Arthur D. Little, Inc., estimates.

3. Containerization Practices

For the most part generators are responsible for supplying portable containers. Of the 18 HWMF/transporters from whom these data were gathered, only one assumed responsibility for supplying containers. In two instances both the generator and HWMF/transporter shared the responsibility; otherwise, the generator provided the containers. Of the 16 HWMF/transporters who responded to the inquiry, 15 said they were satisfied or generally satisfied with generator-supplied containers. However, at the same time, they commented on the typical problems they have encountered, for example:

- There is often bottom corrosion of drums because generators neglect to use pallets.
- Generators sometimes put incompatible materials in the same container.
- Generator-provided stick-on labels come off in the rain.
- There is often poor, improper or nonexistent labeling of wastes.
- Sometimes wastes are not chemically classified.

4. Transport Personnel

As previously stated, about 70 percent of the HWMF/transporters employ ten or fewer people who are directly involved in transportation either as drivers or vehicle maintenance personnel. For the most part, these employees are drivers whose training is focused on safety associated with the vehicle rather than on the hazards of the wastes being transported. In about 80 percent of the facilities, these ten or fewer employees represent less than 50 percent of the total number of employees of the facility. The non-transportation employees are involved in waste treatment and disposal, administration, and clerical support activities.

5. Waste Handling Procedures

Whether or not term or retainer contracts between the HWMF/transporter and the generator are in effect, the generator usually initiates the process by requesting transportation services. Usually each transaction is treated as a separate service procurement whereby the materials are described and the terms and conditions of pickup and delivery are specified.

When the containers used are either drums or barrels, they are almost always provided by the generator and are loaded onto the transport vehicle by the generator either by forklift truck or by hand. If the container is the transport vehicle itself (e.g., tank truck), the HWMF/transporter takes part in the loading; if a vacuum truck is used, the HWMF/transporter does the loading. It is uncommon for HWMF/transporters to mix wastes in tank or vacuum trucks from different generators. Whatever mixing occurs is done by the generator before the HWMF/transporter arrives. Furthermore, multiple stops at different generators to pick up loads is uncommon.

Several HWMF/transporters indicated that they chemically analyze materials either prior to or upon receipt of wastes. In situations where the generator is unknown or not "trustworthy," the HWMF/transporter insists on chemical analysis prior to accepting a job.

Some facilities do not have chemical analysis capabilities, although most do have them. In either event, if the HWMF/transporter engages in treatment or reclamation, it takes care to ascertain contents in order to protect its equipment. With respect to delivery to the disposal site by HWMF/transporters, there is invariably someone at the site to accept the waste.

6. Marking, Labeling, and Placarding

No firm indicated that it was not behaving responsibly with respect to marking, labeling, and placarding requirements. That is, their motor vehicles bear an identification of the company and a placard indicating the hazardous nature of the materials being transported. In this respect, most of the facilities indicated that they followed DOT regulations. In instances where DOT was not cited, the HWMF/transporter identified state (e.g., California, Texas, Ohio) regulations as the controlling factor for marking and describing the nature of the cargo.

With respect to labeling, the HWMF/transporters indicated that they properly identified the materials contained in drums or barrels. However, many indicated that generators or other transporters either did not take care in labeling or were ignorant of the importance of proper labeling.

D. BUSINESS/ADMINISTRATIVE PRACTICES

1. Shipping Documents

Nearly all the HWMF/transporters indicated that they prepare and retain documents which at a minimum describe the quantity, source, waste type, and delivery point for each transport/disposal job. These records, which contain signatures upon delivery or transfer are in one form or another, including: billing records (invoices), shipping documents or bills of lading, purchase orders or job tickets, and self-initiated or state-required manifests. Sample shipping documents appear in Appendix D. Usually these documents, which represent stages in a transaction, are filed together. Among the states which require record keeping and reporting to show quantity, source, waste type, and delivery point are: California, Illinois, Indiana, New York, Michigan, Ohio, Oklahoma, and Texas.

Based upon common business practice and upon the requirements of the IRS (7-year retention for financial records), the ICC (3-year retention), state tax departments, and other cognizant state agencies, it is safe to assume that these documents are being retained for several years. In those states where a manifest system has been, or is about to be, implemented the norm for record retention is two to three years.

2. On-Site Storage

HWMF/transporters admit to a minimal amount of on-site storage at their treatment or disposal facilities. However, no instance of off-site storage was discovered.

3. Safety Practices

As might be expected, no HWMF/transporter suggested that it was not taking safety precautions or did not have adequately trained employees. In many instances, "DOT spill-handling procedures" were cited as being in effect (these were not explained satisfactorily). Many firms indicated that they provided driver training, including safety training concerning the nature of materials transported. However, discussions with staff of the cognizant agencies in several states suggested that, in many instances, training was inadequate.

Data with respect to vehicle inspection/certification and maintenance are sketchy. However, many of the HWMF/transporters indicated that the states in which they operate have motor vehicle inspection/certification requirements; several indicated that they perform their own inspection to be assured of certification.

E. REGULATORY CONTROL

As previously discussed in Section IIIB5, the DOT administers Federal regulations pertaining to interstate transport of hazardous materials by public highway, including motor vehicle safety. Furthermore, many states have adopted these regulations, or portions thereof, for intrastate transport of hazardous materials. The foregoing regulations apply to HWMF/transporters conveying hazardous wastes which meet the definition of hazardous materials.

It appears that HWMF/transporters are in general ICC-exempt on one or more counts: first, many do not engage in interstate commerce; second, most operate as private carriers*(transporting their own property only as an incidental activity in furtherance of their regular business); third, waste intended for disposal (as opposed to resource recovery, recycling, or reuse) may be an ICC-exempt commodity because the waste is not a manufactured end product possessing economic value (i.e., not "property").

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*According to case law, private trucking is illegal if it is a secondary business with the express purpose of profiting from the transportation.

VI. ECONOMIC DESCRIPTION OF HAZARDOUS WASTE TRANSPORT

A. INTRODUCTION

The basic role of the transportation sector in the management of hazardous waste is to convey hazardous waste from the point of generation to an off-site waste facility for treatment, resource recovery, storage, and/or disposal. The modes of transportation involved in this activity are: motor carrier, rail, water, air, and pipeline, with motor carrier (i.e., motor truck) by far the dominant mode and rail a distant second. The quantity of hazardous waste transported by air and pipeline is minimal.

Three groups of participants have been identified as transporters* of hazardous waste:

- Generator/transporter - Generators, including industrial, commercial, and governmental organizations, that act as private carriers and self-haul hazardous wastes, invariably by truck, to off-site hazardous waste management facilities.
- For-hire transporter - Common and contract carriers, whose principal business is commodity transportation, that transport hazardous waste from the point of generation to off-site hazardous waste management facilities which they do not operate.
- Hazardous Waste Management Facility (HWMF)/transporter - Operators of hazardous waste management facilities that act as contract or private carriers in transporting hazardous waste from the point of generation to treatment, storage, or disposal facilities.

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*The transporter is, by definition, the party providing the motive power for the shipment. Thus, a generator of hazardous waste who owns and loads a rail tank car is considered a Generator/transporter only if that party were to operate the locomotive.

These participants, especially the Generator/transporter, generally do not view themselves as being part of an industry devoted to hazardous waste transportation, and indeed these transportation activities do not conform to the customary definition of an industry. Rather, they view themselves as being engaged in an activity which is part of a larger set of business activities; they engage in hazardous waste transportation because of convenience or for economic reasons, but it is not per se their principal commercial interest. Most for-hire transporters are in the business ot hauling cargo which is only sometimes hazardous waste, although some may specialize in transporting hazardous materials and/or waste. Many of the waste management facilities (HWMF/transporters) are engaged in waste transportation as a complement to their other waste handling activities.

The supply and demand elements of this sector are dictated by the quantities and characteristics of the hazardous waste generated. A small firm generating a low volume of hazardous waste is more likely to use its own trucks to transport the wastes off-site. Also, this may occur when contract transporters refuse to handle small quantities of waste. On the other hand, firms generating high volumes of hazardous waste may require contract transporters to collect the wastes daily, weekly, or as necessary, if they do not haul themselves.

The choice of transport mode depends upon the distance of the hazardous waste management facility from the point of generation, the frequency of collection, the environmental setting, the plans for usage of the hazardous waste, and the like. For example, a firm located on or near a waterway may utilize barge transportation. Or firms that have hazardous wastes transported over 50 miles may employ truck or rail services. These examples are prevalent particularly when hazardous waste goes to a resource recovery facility.

The mode of transport used for hazardous waste is predominantly truck (94 percent by weight), with some rail (5 percent) and a limited amount of barge transport (1 percent). The amount of hazardous waste transported by air carrier and pipeline is negligible. Generators that self-haul and HWMF/transporters invariably use truck transport. The shipper (generator) usually owns rail tank cars and occasionally barges; however, rail and barge transport is exclusively performed by a for-hire transportation company.

B. ECONOMIC CHARACTERISTICS OF FIRMS ENGAGED IN TRANSPORT

1. Generators

The EPA has identified a number of industries which generate potentially significant amounts of hazardous waste. Table VI-1 lists those generator industries as well as the 1975 value of shipments and number of establishments in each industry.

All but one of the industries (waste oil re-refining) fall within the manufacturing sector SIC codes (20XX to 39XX). Generators, as the producers of hazardous waste, create the need for hazardous waste management. If the generator does not treat, store, or dispose of the hazardous waste on-site, then the waste must be transported from the generating location to an off-site hazardous waste treatment facility, which the generator may or may not own. The generator ordinarily incurs the cost of transport* as part of the cost of off-site treatment, storage, or disposal, whether the waste is hauled by the generator itself, the hazardous waste management facility, or an independent for-hire transportation company.

The waste oil re-refiners are part of SIC 5093, Scrap Service and Waste Products, which includes scrap metal dealers and sellers of textile waste as well as petroleum re-refining. The total sales for SIC 5093 were $9.7 billion for the twelve months ending August 1977[1], the transport cost of re-refiner's waste is small in comparison. However, this may be misleading if re-refiners are a small portion of industry 5093 sales.

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*Although a generator may be paid for waste delivered to a resource recovery facility, the generator still bears the cost of transport.

TABLE VI-1

TOTAL COST OF HAZARDOUS WASTE TRANSPORT TO SELECTED GENERATING INDUSTRIES

($ Millions)

Industry	SIC Code	1975 Value of Shipments[a]	Estimated 1975 Value Added[b]	1972 Number of Establishments[c]	Hazardous Waste Disposed Off-Site Wet Metric Tons[d]	Estimated Cost of Waste Transport[e] Upper Bound	Estimated Cost of Waste Transport[e] Lower Bound	Waste Transport Cost as % Value-Added Upper	Waste Transport Cost as % Value-Added Lower
Textiles	22XX	13,348.9	5,501.3	4,572	103,000	3.4	0.4	0.06%	<0.01%
Pharmaceuticals	2831	758.2	478.4	182	62,050	2.0	0.2	0.03	<0.01
	2833	1,484.4	757.9	140					
	2834	8,178.2	6,452.3	756					
Inorganic Chemicals	281X	8,177.7	4,316.9	1,419	567,000	18.7	2.3	0.43	0.05
Paints & Coatings	2851	4,677.5	2,192.3	1,599	139,450	4.6	0.6	0.21	0.03
Organic Chemicals, Pesticides, Explosives	2869,	14,017.1	7,582.0	514	1,300,000	42.9	5.2	0.47	0.06
	2879,	2,265.9	1,179.2	388					
	2892	412.3	288.0	93					
Petroleum Refining	2911	52,169.6	9,247.4	323	844,000	27.9	3.4	0.30	0.04
Leather Tanning	3111	1,027.1	357.0	517	164,350	5.4	0.7	1.51	0.20
Metal Smelting & Refining	3331,	2,371.1	417.4	31	351,000	11.6	1.4	0.65	0.08
	3332,	NA	NA	16					
	3334,	2,759.8	1,149.1	31					
	3339	578.6	219.2	82					
Electroplating & Metal Finishing	3471	1,230.9	881.9	3,265	2,837,000	93.6	11.3	10.60	1.28
Special Machinery, Office Machines	355X	8,267.8	4,965.7	3,681	145,000	4.8	0.6	0.04	<0.01
	357X	11,061.2	6,224.7	993					
Electronic Components	3671-79	9,799.7	5,917.2	5,232	55,700	1.8	0.2	0.03	<0.01
Storage Batteries	3691	1,291.1	636.2	213	353,000	11.6	1.4	1.82	0.22
Waste Oil Re-refining	5093	9,690.0	NA	7,139	55,000	1.8	0.1		
Totals		153,567.1	57,764.1	31,186	6,976,550	230.1	27.9	-----	-----

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[a] Reference 34

[b] Reference 35 (1972 Value Added ÷ 1972 Value of Shipments) x 1976 Value Shipments

[c] Reference 34

[d] Table IV-1

[e] ADL estimates based upon lower bound cost/ton-mile of $0.08, an upper bound cost/ton-mile of $0.66, 50-mile round trip.

[f] Percent of value of shipments

For generators, the management of hazardous waste is an activity necessary to continuance of the manufacturing process but is ancillary to their principal business. Table VI-1 contains an estimate of the range of cost of hazardous waste transport based upon the range of known truck transport rates. While the transport cost relative to industry value of shipments varies, it is a very small portion of total value-added in each SIC category, with the exception of the Electroplating and Metal Finishing industry, where it may reach 10 percent.

2. Hazardous Waste Management Facilities

a. Supply/Demand

A number of hazardous waste management facilities provide transportation service as a means of obtaining a hazardous waste to treat, store, or dispose. Often, the price for the transport service is embedded in the overall management cost and not shown or quoted as a separate item. Where price is broken out, it is quite variable from facility to facility ($0.075 to $1.00 per ton-mile); however, hazardous waste management facilities do not seem to keep track of transport costs separately from disposal costs.

Some hazardous waste management facilities are owned by large corporations--for example, Chemtrol and Rollins--while others are owned by small companies operating only one or two facilities. In 1975, five firms generated over one-third of total industry sales, while hazardous waste management revenue varied from $12,000 to $12 million per firm.[1] Table VI-2 depicts the distribution of hazardous waste management facility sales in 1975. According to this distribution, the median sales value was $1.0 million.

b. Financial Profiles

The pro-forma financial statements shown in Table VI-3 were derived from data developed by an EPA contractor.[1] These data

TABLE VI-2

DISTRIBUTION OF HAZARDOUS WASTE MANAGEMENT COMPANIES BY SALES VOLUME

1975

Sales Volume	Percentage of Firms in Sales Bracket
Up to $100,000	19
$100,000 - $500,000	21
$500,000 - $1,000,000	15
$1,000,000 - $2,000,000	31
$2,000,000 - $5,000,000	10
$5,000,000 or greater	4
Total	100

Median Value = $1,000,000

SOURCE: Reference 1.

TABLE VI-3

FINANCIAL PROFILE OF HAZARDOUS WASTE MANAGEMENT FACILITIES ALSO ENGAGED IN TRANSPORTATION

INCOME STATEMENT

	Percent of Total Revenues
Expenses	78.6
Depreciation	9.6
Operating Profit	11.8
Other Income (Expense)	(3.7)
Profit Before Tax	8.1
Tax	3.9
Profit After Tax	4.2

BALANCE SHEET

Assets		Liabilities	
Current Assets	30.9%	Current Liabilities	32.9%
Fixed Assets	69.1	Long-Term Debt	35.6
Total Assets	100.0%	Equity	31.5
		Total Liabilities	100.0%

SOURCE: Derived by Arthur D. Little, Inc., from Reference 1.

were used as the basis of the economic impact assessment of RCRA Section 3003 regulations upon the hazardous waste transport sector.

At the present time, about 67-75 percent of disposal facilities also provide transportation service. They also typically accept waste transported by generators and for-hire transportation companies. Because the total amount of hazardous waste transported by hazardous waste management facilities as a whole is unknown, the total cost of transport incurred by them cannot be determined. There is no way at present to determine the portion of total revenue/cost shown in Table VI-1 that is attributable to hazardous waste management facilities. The impact assessment to follow (Section VIII) is therefore based upon the "average" facility as represented by the pro-forma models contained in Reference 1.

3. For-hire Transportation Companies

a. Supply/Demand

For-hire transportation companies carrying hazardous waste are predominantly trucking companies, aside from the relatively few instances of barge transport or rail shipment. For most for-hire trucking companies, hazardous waste is but a small portion of their total business, and they view the shipment of hazardous waste in the same way as the shipment of hazardous material.

Because the total amount of hazardous waste carried by for-hire transportation companies as opposed to generators and HWMF/transporters is unknown, there is no way at present to determine the portion of total revenue/cost shown in Table VI-1 that is attributable to for-hire transportation companies.

b. Financial Profiles

Pro-forma financial statements for for-hire transporters of hazardous waste, developed from a composite of sources,[33,38] are shown in Table VI-4. Each of the sources used was also based upon a composite of companies, so any given company could vary appreciably from the pro-forma company. However, the pro-forma financial statements are consistent with investment costs and depreciation periods for truck equipment described in Chapter VII, Process Economic Models. The pro-forma trucking company also includes capital assets other than trucks, amounting to 16 percent of fixed assets; general and administrative expenses for this type of company amount to 15 percent of sales.[38]

In general, the financial risk perceived for a trucking company is less than that for a hazardous waste management facility of comparable size. Transportation companies do not have the long-term liabilities of hazardous waste management facilities, do not have their pollution problems, and together possess a greater experience base for the evaluation of financial risk. Also, the assets of truck companies engaged in hazardous waste transport are trailers and tractors which are fungible with those used in the transport of other commodities. In simple terms, this means that if a bank must repossess a truck due to payment default, there is a market for such vehicles so that the bank has less at risk if the truck company cannot meet its payment obligations. Trucking companies are generally able to finance equipment purchase. Smaller companies may be required to put up more of a down payment than larger companies (20 percent versus 10 percent) in the case of purchased equipment with bank financing. Also, the truck company has the option of leasing the equipment.

TABLE VI-4

FINANCIAL PROFILE OF FOR-HIRE TRANSPORTERS OF HAZARDOUS WASTE

INCOME STATEMENT

	Percent of Total Revenues
Expenses	84.2
Depreciation	9.9
Operating Profit	5.9
Other Income (Expense)	(0.4)
Profit Before Tax	5.5
Tax	2.6
Profit After Tax	2.9

BALANCE SHEET

Assets		Liabilities	
Current Assets	33.1%	Current Liabilities	15.8%
Fixed Assets	66.9	Long-Term Debt	28.8
Total Assets	100.0%	Equity	55.4
		Total Liabilities	100.0%

SOURCE: Derived by Arthur D. Little, Inc., from References 33 and 38.

To contrast for-hire transporters with HWMF/transporters, the latter can also probably obtain similar financing for truck equipment but not for investments in incineration equipment, pollution control equipment, and landfill construction.

C. ECONOMIC CHARACTERIZATION OF HAZARDOUS WASTE TRANSPORTATION

1. Substitutes and Alternatives

There is potential substitution of one mode of transport for another and substitutability among transportation services that could be provided by generators, for-hire transporters, or hazardous waste management facilities. In addition, some generators have the option of on-site disposal, which may or may not require transportation service.

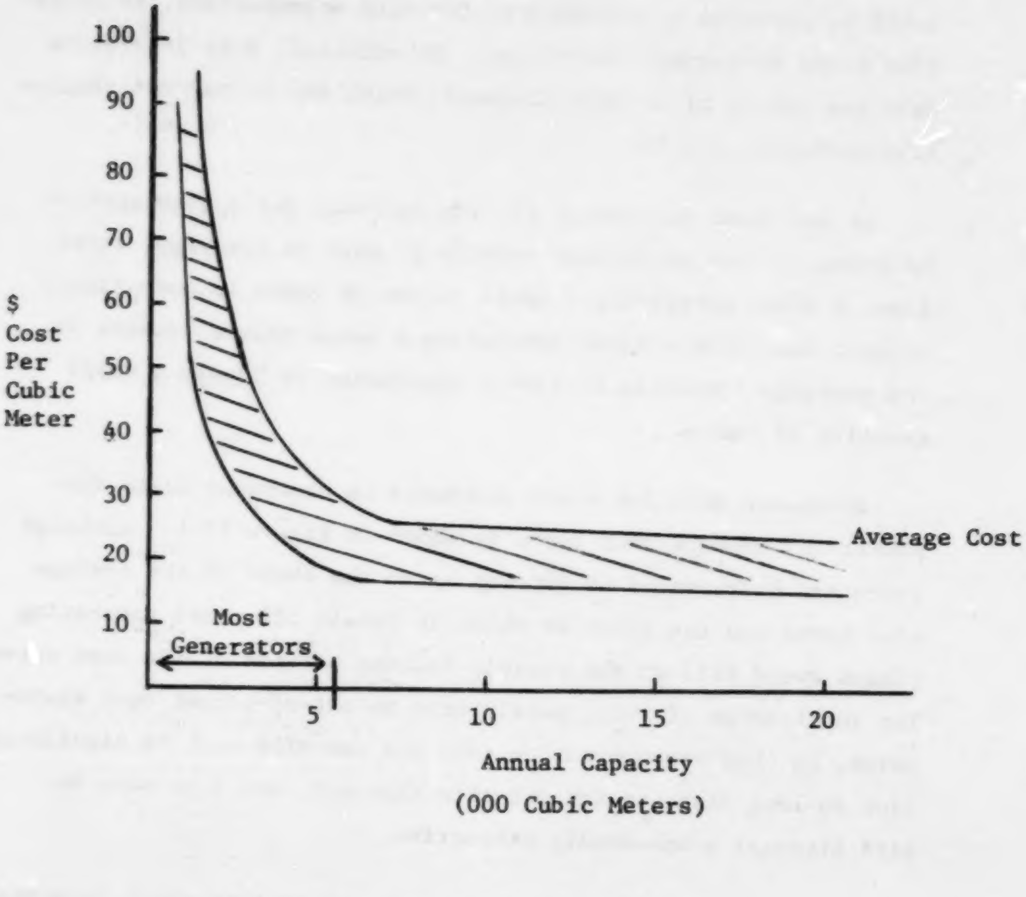
As mentioned in Chapter IV, the decision for a generator to self-haul or use an outside service is made at the plant level. Also, a plant generating a small volume of waste is more likely to self-haul than a plant generating a large volume because of the probable inability to find a contractor to handle a small quantity of waste.

There are definite scale economies in hazardous waste disposal; the average cost curve is shown in Figure VI-1. Although there are differences of opinion as to the shape of the average cost curve and the point at which it levels off, most generating plants would fall on the sharply falling portion of the cost curve. The implication of this, purely from an out-of-pocket cost standpoint, is that transportation cost per ton-mile must be significant (due to long distance for off-site disposal, etc.) to make on-site disposal economically attractive.

As mentioned above, there are non-cost factors which determine whether off-site disposal, and therefore hazardous waste transport, is selected. For example, generators desire to eliminate their liability

FIGURE VI-1

AVERAGE COST FOR HAZARDOUS WASTE DISPOSAL AT SECURE LANDFILLS



associated with disposal and also may not have available to them land for on-site disposal. These factors permit contractors to charge a premium for hazardous waste transport and disposal. The nature of hazardous waste disposal and the role of hazardous waste transport in this process indicate that the price elasticity of demand for the transportation activity is likely to be inelastic.

2. Capacity Utilization and Growth

Hazardous waste management facilities have been operating at about 50 percent of capacity in recent years.[1] At the same time, transportation equipment at hazardous waste management facilities has been operated at 75-80 percent of capacity.[32] This study has found that for-hire transporters utilize their trucks at nearly 100 percent of capacity (8-14 hours/day).[*] Generators who self-haul appear to have the lowest capacity utilization rates because they typically make one short haul per day.[**] The implication of current capacity utilization rates are that HWMF/transporters can handle some expansion in hazardous waste transported without purchasing additional equipment, while many for-hire transporters would require additional equipment if the amount of hazardous waste transported off-site increased significantly.

3. Pricing Practices

Generators of hazardous waste who self-haul do not provide hazardous waste transport services to other firms.[32] They, however, ultimately pay the price for hazardous waste transport either through out-of-pocket cost for their own trucks and tank cars or through purchase of the service as part of, or ancillary to, hazardous waste disposal.

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[*] Section III.B.3.b

[**] Section IV.C.2

For-hire transportation companies can operate as common or contract carriers. In the former case, particularly where interstate transport is involved, the transport rate may be a tariff price. This is particularly true for all rail shipments and also applies to some truck transport. In the latter case, the price is a figure mutually agreed upon by the generator and hauler.

As previously mentioned, hazardous waste management facilities that also provide transportation service often do not break out the transportation charge. Where they do, the range varies widely, from $0.075 to $1.00 per ton-mile,[32] without apparent explanation. Since hazardous waste management facilities do not generally keep track of transport costs, the price for transport could be below the average transportation cost per ton-mile under some conditions.

There are no apparent constraints upon pricing and the ability of individual transportation parties to change prices, except competition from illegal dumpers and long-term contractors. Many hazardous waste management facilities complain about their inability to price-compete with illegal dumpers.[32] Long-term contracts that do not allow for cost pass-through could defer price increases to cover cost increases. However, the extent of the use of this type of contract is unknown.

VII. COST OF COMPLIANCE WITH RCRA SECTION 3003

A. PROCESS ECONOMIC MODELS

1. Approach

In order to assess the incremental cost of compliance with standards pursuant to Section 3003 of RCRA for transporters of hazardous waste, a data base was established to provide cost representations for each segment of the hazardous waste transport industry.[*] Cost elements and other entities of interest in the configuration of the cost representations include:

- capital cost of transport equipment;
- annual operating cost of transport equipment;
- type of hazardous waste transported;
- transport equipment type (capacity, features);
- annual mileage;
- annual volume of waste transported;
- roundtrip transport distance;
- charge rate for tonnage hauled.

The most common transport operations in each of the industry segments is used in the analysis. Transportation operations differ according to the type of waste transported and according to the type of transport equipment used in moving the various waste types. Information presented earlier indicates that transporters in each industry segment employ basically the same type of transport equipment for containment of wastes in transit. For example, lined or insulated tank and vacuum units generally contain spent acids, spent caustics, hydrocarbons, and some solvents. Aluminum and stainless steel units (uninsulated or unlined), and drums contain numerous waste types, e.g., oily waste, flammable waste, cyanide waste, sludges, etc., that do not react with materials containing them. In essence, the weight and chemical/physical properties of the waste dictate the type of transport equipment to be used.

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[*] The term "industry" is used hereafter to mean those firms engaging in the transport of hazardous waste.

The primary information source of this chapter is based on personal communication with firms engaged in hazardous waste transportation. Transporters contacted were unwilling, for the most part, to discuss capital and annual operating costs for transport equipment. Some transporters did supply the rates charged for tonnage hauled and fragmented examples of what a typical hauling trip would entail. To circumvent the problem of fragmented information, several scenarios were formulated to provide an adequate representation of the industry.

Based on specifications from the preceding industry characterization and contacts with several manufacturers of transport equipment and trucking associations who supplied information regarding capital and operating costs of equipment used in hazardous waste transport, five truck scenarios and one rail scenario were developed to serve as transport models. Several associations and transporters were recontacted to verify the resulting data, and these contacts also suggested revisions when the figures used were considered non-representative. Thus, the scenarios depict expenses for the most common transport operations discovered in the industry, and, in turn, are used in the models which examine the economic impacts resulting from compliance with standards governing the transport industry.

The individual truck transport models were combined along with company financial characteristics to approximate fleets that are representative of hazardous waste management facility fleets and for-hire transporter fleets. Generator fleets were analyzed on a stand-alone basis because waste transport is such a small portion of their total cost of operation.

B. TRANSPORTATION MODELS

1. Vehicle Types

Process economic models were developed for five truck vehicles and one rail tank car; they are described in Table VII-1. The process economic models for trucks were based on the "Trip Distance/Frequency" scenarios shown in the table. In addition a number of assumptions were used in the formulation of the truck costs and scenario parameters, as follows:

- The driver workday is eight hours, five days per week;[21,22]
- There are 250 operating days per year;
- The driver's salary plus fringe benefits is approximately $23,000;[21,22]
- Vehicle insurance, licenses and taxes, amount to $3,500 per truck;[21]
- Fuel cost is $0.55 per gallon;[22,26]
- Vehicles travel at an average speed of 40 miles per hour;
- Vehicle loading and unloading time averages two hours per trip for tank trucks, and three hours per trip for flatbeds;
- Vehicles obtain six miles per gallon of fuel.[22,26]

Tonnage capacity for equipment was based upon the following measurement units:

- 231 cubic inches per gallon;
- 1728 cubic inches per cubic foot;
- 70 pounds of bulk waste per cubic foot;*
- 2000 pounds per (short) ton.

In addition, waste moving in bulk was estimated to have an ullage of 10 percent for both truck and barge transport.

Truck tractors and trailers have a useful life of eight to ten years under normal conditions. Power equipment with gasoline engines may transport up to 100,000 miles before major maintenance is needed,

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*Many bulk wastes are aqueous solutions or solvents. Some are lighter than water (petroleum wastes) while others are heavier (spent sulfuric acid, chlorinated solvents). The truck models are based on the assumption that the wastes, on average, will be slightly heavier than water.

TABLE VII-1

HAZARDOUS WASTE TRANSPORTATION

VEHICLE SCENARIO MODELS

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Description	Three axle, power unit tractor; unlined aluminum tank unit (4,500 gal.)	Two axle, power unit tractor; unlined aluminum tank unit (1,600 gal.)	Semi-tank, three axle power unit trailer; unlined aluminum tank unit (6,000 gal.)	Tilt-frame with 40-foot roll-off container (80, 55 gal. drums). Three axle power unit tractor	Straight truck with 20-foot bed (30, 55-gal. drums)	Lined tank rail car with capacity of 13,350 gal.
Typical Trip						
Roundtrip Distance	40 miles	10 miles	200 miles	50 miles	25 miles	12,500 mi/yr.
Trips/Day	2 trips	3 trips	1 trip	2 trips	2 trips	
Waste Tonnage/Trip	19 tons/trip	7 tons/trip	25 tons/trip	18 tons/trip	8 tons/trip	90 tons
Ton-miles/year	190,000 ton-mi.	26,250 ton-mi.	625,000 ton-mi.	225,000 ton-mi.	50,000 ton-mi.	1,125,000 ton-mi.
Capital Cost						
Tractor	$35,000	$25,000	$35,000	$35,000		
Truck	12,500	10,000	20,000	13,000[c]	$24,000	$33,000
Container				2,000		3,500
	$47,500	$35,000	$55,000	$50,000	$24,000	$36,500
Operating Cost						
Salary plus fringes	$23,000	$23,000	$23,000	$23,000	$23,000	
Insurance, Taxes, etc.	3,500	3,500	3,500	3,500	3,500	$60,600[d]
Fuel, Oil, Tires	5,000	1,500	12,500	6,250	2,500	
Maintenance & Repair	1,000	375	2,500	1,250	625	900
Total Annual	$32,500	$28,375	$41,500	$34,000	$29,625	$61,500
Operating Cost/Ton-Mile[a]	$0.17	$1.08	$0.07	$0.15	$0.59	$0.055
Annual Ave. Cost/ Ton-Mile[b]	$0.21	$1.28	$0.08	$0.18	$0.66	$0.058

[a] Total Operating Cost ÷ Annual Ton-miles

[b] (Total Operating Cost - Annualized Capital Cost) ÷ Ton-miles

[c] Hoist Frame

[d] Rail transporter net charge

Source: Arthur D. Little, Inc., estimates.

while diesel engines may not require major maintenance for 200,000 miles. While vehicles making short trips will get 8 to 20 miles per gallon of fuel, 6 miles per gallon was suggested as a good average for modelling.[21,22,26]

Each of the models in Table VII-1 has the following components:

- Description;
- Typical trip;
- Capital costs;
- Operating costs.

The description and typical trip components complete the transport scenario. While generators, for-hire transporters, and hazardous waste management facilities could have any of these trucks in their fleet, generators would be better represented by the short-haul scenarios (Models 2 and 5)*. Model 6, a lined rail tank car, is also particular to generators, since they either own or lease their own rail tank cars.[26]

The "Capital Costs" represent the estimated purchase price of the tractor and trailer truck units in Models 1 through 5 and the cost of a rail tank car in Model 6. Additional truck equipment costs are shown in Table VII-2. According to manufacturers, trucking companies may order optional equipment and accessories.[28] The cost models employ only the basic equipment required to fit the scenario.

Operating costs for trucks are principally comprised of the truck driver's salary, fuel costs, insurance and taxes, and maintenance costs. The insurance costs are primarily for liability insurance and are therefore not vehicle-size or value dependent.

The annual operating costs per ton-mile, exclusive of capital charges, vary with the size and capacity of the vehicle. Long distance, large volume vehicles have considerably lower operating

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*Table IV-2.

TABLE VII-2

ADDITIONAL TRANSPORTATION EQUIPMENT COSTS

Type	Size/Capacity	Approximate Cost Range, Dollars
Semi-tank trailers	6000 gallons	
rubber-lined		25,000-30,000
stainless steel uninsulated		37,000
stainless steel insulated		42,000-45,000
Tank trucks	1600-4500 gallons	10,000-16,000
tank units		
Vacuum trucks		
power unit	2 axle	25,000
vacuum units	1600-2200 gallons	16,000-18,000
Straight truck	light to heavy model	12,000-30,000
Tank accessories (pump, hoses, etc.)		3,000+
Used power equipment	2 or 3 axle	10,000+

SOURCE: Reference 26 .

costs per ton-mile than small, short-haul vehicles ($0.07 - $0.17 per ton-mile versus $0.42 - $1.08 per ton-mile, respectively). A common price for bulk waste transport is about $0.12 per ton-mile, with values ranging to over $1.00 per ton-mile. The scenarios produce costs per ton-mile covering this range. Transportation scenarios 1, 3, 4 and 5 are representative of hazardous waste transport by for-hire trucking companies and hazardous waste management facilities. Scenario 2 is more representative of a self-hauling generator, although many self-haulers would have a lower capacity utilization.

Data collected from railroads on rail shipments of hazardous waste are contained in Appendix E. Additional information was obtained from a rail tank car manufacturer. From the data in Appendix E, it becomes apparent that spent sulfuric acid comprises most of the hazardous waste shipped by rail. Spent sulfuric acid moves in lined tank cars of 13,350 gallons capacity. The lining (rubber or epoxy) depends on the composition of the waste.

Tank cars can be leased or purchased. The base price of the car is $33,000 new, plus $2,000 to $5,000 for the lining; delivery time is 5-6 months following order placement. The usual lease period is 12 years, with the investment tax credit accruing to the lessor. An approximate lease rate is $375 per month, which covers maintenance, taxes and a multitude of other smaller items, as well as capital cost.

When the shipper or consignee supplies a tank car, the railroad makes "mileage payments" to the owner. If the car is leased, the lessor offsets the mileage payment against the lease payment (up to 100%), so the payment accrues to the shipper. The mileage payment depends on the depreciated value of the car. For the type considered here, it is $0.21 per loaded mile for a new car and $0.18 for one that is old but not ancient. In the calculations, $0.20 was used. The average tank car travels 12,500 loaded miles/year.

Barge transport of hazardous waste is infrequent and the provisions of Section 3003 are similar to existing Coast Guard regulations, so that no barge model was constructed.

Based upon the limited information available, the following costs and prices were found for barges:

- Capital cost: $175,000 to $200,000;
- Rate $10 to $12 per ton of cargo.

A typical one-way trip could originate in the Great Lakes and terminate in Houston--a distance of 1200 miles. A 3-compartment, double-hulled tank barge with a capacity of 1400 tons would be suitable for hauling bulk hazardous waste.

2. Facility Models

The truck models described above were then employed to simulate for-hire transportation companies and hazardous waste management facilities.

As discussed in Section III.B, the median fleet size of truck transporters is 14 and the average distance per round trip is 50 miles. The model truck transporter company was assumed to own two vehicles each of Model types 1, 2, 3, and eight of Model type 4. This combination of transport scenarios is equivalent to an average roundtrip distance of 64 miles.

The hazardous waste management facilities have an average fleet size of seven vehicles. The hypothetical company was assumed to have one each of truck Models 1, 2, and 3 and four of Model type 4. The same assumptions as to depreciation, equipment life and financing were used for both (see Chapter VIII).

C. COMPLIANCE ACTIVITIES REQUIRED UNDER SECTION 3003

Regulations applicable to transporters of hazardous waste were proposed pursuant to Section 3003 of RCRA (42 USC 6901) on April 28, 1978 (see Appendix A). These regulations, summarized below, contain provisions for registration, recordkeeping; acceptance, handling, and delivery of hazardous waste; marking of vehicles; and reporting of incidents for transportation of hazardous wastes requiring a manifest under Section 3002 of the Act.

1. Scope

The regulations apply to any person or Federal agency that transports hazardous waste within the United States, excluding transport on the site of a hazardous waste generator or permitted hazardous waste management facility. All transporters must comply with applicable hazardous materials regulations of the DOT.

2. Registration

Transporters must notify the EPA or authorized state agency that it transports or intends to transport hazardous waste. Upon notification, the transporter will obtain from the EPA an identification code which must appear on 1) all manifests it handles, 2) any incident report, and 3) the delivery document, if one is issued.

3. Recordkeeping

Recordkeeping provisions require that the transporter maintain for at least three years 1) a copy of the manifest, or 2) a delivery or other shipping document which contains certification of receipt of waste at a permitted hazardous waste management facility.

4. Acceptance/Manifest Compliance

In accepting the hazardous waste, the transporter must obtain a manifest signed by the generator certifying that the waste has been properly described, labelled, contained, and designated for shipment to a permitted facility. The transporter must sign the manifest acknowledging acceptance of the waste. Subsequent transporters handling the same shipment must obtain or prepare a manifest or shipping document containing prescribed information.

5. Handling

In handling the wastes, the transporter must load and stow the wastes so that hazardous materials which are incompatible do not come in contact with one another. It is the transporter's responsibility to replace labels lost during shipment and to report any leaking containers. Transporters must not transport containers which are leaking or appear to be damaged.

6. Delivery

Upon delivery of the waste only to the permitted hazardous waste management facility designated by the generator,

(a) the transporter must obtain certification of delivery on the manifest from an authorized agent of the facility, or

(b) if the transporter cannot obtain immediate certification of delivery, such certification on the manifest or delivery document must be acquired within five working days after delivery of the shipment.

7. Spills and Reporting

The regulation provides for expeditious handling of a spill which represents a hazard to human health or the environment whereby the transporter is required to a) telephone immediately the National Response Center, U.S. Coast Guard, or predesignated on-scene coordinator; b) file a written report to the DOT; and c) clean up the spill or take other action as may be required by Federal, state or local agencies.

8. Marking of Vehicles

Placarding requirements apply to hazardous waste meeting DOT's definition of a hazardous material. All hazardous waste transporters whose vehicles require DOT placarding or are carrying more than 1000 pounds of hazardous waste must mark their vehicles with:

- The name of the transporter; and
- The city or community of the home office.

D. COST OF COMPLIANCE

1. Registration

All transporters must initially register with the EPA or authorized state. A base expense of $24 is estimated for employer time (1 hour at $20 including fringes) and a clerk's time (1/2 hour at $8 including fringes) as follows:

Owner time:	1 hour at $20 =	$20
Clerk time:	1/2 hour at $8 =	4
	Total	$24

2. Recordkeeping

Existing DOT and ICC regulations apply to rail carriers. As a result of routine railroad industry recordkeeping practices, there is no incremental cost of recordkeeping for rail carriers because existing bills of lading, etc., can be modified and used as Section 3003 manifests.

For intrastate truck transporters, annual recordkeeping expenditures would occur in those states where three-year requirements do not currently exist (24 states). Costs for maintaining these records are estimated at one hour of clerical time for filing per month plus $20 per year for three years for storage. Unit costs per truck per year operated in a state with no recordkeeping requirements are therefore:

Clerk's time	1 hour/month	12 x $8 = $96
Annual storage		20
	Total	$116 per truck/year

These costs amount to a maximum of 0.4 percent of annual operating costs for any one of the five truck models in Scenarios 1-5.

3. Compliance with the Manifest System: Acceptance and Delivery

Compliance with the acceptance and delivery requirements of the manifest system (e.g., acquiring certification of delivery from an authorized agent of the permitted facility, checking containers for proper labelling and replacing labels when necessary, and issuing a delivery document when appropriate) will require additional attention and time on the part of the driver. For tank trucks the signing of the manifest can usually be accomplished during vehicle loading and unloading (for which a total of three hours per trip is allowed in the cost models). If no one is available to sign the manifest at the hazardous waste management facility, additional time at the end of the day might be required for additional paper work by the driver. If this happens every other day, an incremental time requirement of 15 minutes for one out of every six trips will constitute an additional cost of compliance for tank truck transport:

Truck driver's time: 0.25 x $12/hour x No. trips/6 = $0.50/trip.

For flat-bed trucks where drums are not containerized or palletized, tailgate delivery is probably used. In those cases (Models 4 and 5), an extra 15 minutes is allowed for loading and unloading time for signing the manifest:

Truck driver's time: 0.25 x $12/hour = $3/trip.

Model 5 provides 45 minutes per day of slack time, so that the cost above represents an opportunity cost rather than an extension of an eight-hour day or reduction in number of trips per day.

No measurable incremental cost of compliance with the manifest system will be incurred by rail transporters, because the EPA requirements can be accomodated by the current bill of lading/waybill.

4. Handling

No additional costs are expected for this section of the regulation.

5. Spills and Reporting

Table VII-3 depicts the number of unintentional releases of hazardous materials during transportation. The information is compiled by DOT's Office of Hazardous Materials. The overwhelming majority of incidents do not pertain to hazardous waste requirements under Section 3003 because they were associated with virgin (non-waste) materials and include spills from small packages and minor splashes from large containers.

Table VII-4 depicts the property damage from hazardous materials incident reports. The average damage from a spill was about $1600 and 50 percent of the spill reports were for damage under $100.

Detailed reports of an incident are due from carriers within 15 days, with immediate notification required when the release results in death, injury, estimated property damage over $50,000 or spillage of radioactive material or etiologic agents.

A study* for EPA estimated the cost of cleanup for a land spill (as opposed to water), as shown in Table VII-5. These costs for a typical hazardous material spill include one or more of the following steps:

- Containment by plugging sewers, building dikes, etc;
- Removal of spilled material from site using vacuum pump equipment, earthmoving equipment and/or sorbants;

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* Estimation of the Frequency and Costs Associated with Cleanup of Hazardous Materials Spills, Preliminary Draft Report to the EPA, April 1978, Arthur D. Little, Inc.

TABLE VII-3

HAZARDOUS MATERIALS INCIDENT REPORTS-
REPORTING CARRIERS AND REPORTS SUBMITTED

The following tables list by mode of transport the number of reporting carriers and the number of HMI reports submitted by each mode.

Mode	Reporting Carriers							Percent
	1971	1972	1973	1974	1975	1976*	Total*	of Total
Air Carriers	3	11	15	32	31	40	50	4
Hwy Carriers (For-hire)	233	323	353	380	392	600	700	62
Hwy Carriers (Private)	54	58	73	82	116	200	250	22
Rail Carriers	28	35	35	40	44	50	75	7
Water Carriers	10	8	7	17	23	40	50	4
TOTAL	328	435	483	551	606	930	1,125**	See Note

Mode	Reports Submitted							Percent
	1971	1972	1973	1974	1975	1976	Total*	of Total
Air Carriers	5	32	48	155	152	150*	550	1 1/4
Hwy Carriers (For-Hire)	1,633	3,613	5,092	7,254	8,988	9,900*	36,500	83
Hwy Carriers (Private)	258	352	450	361	903	950*	3,300	7 1/4
Rail Carriers	346	337	412	617	675	1,000*	3,400	7 1/2
Water Carriers	13	10	12	26	32	50*	150	1/4
TOTAL	2,255	4,344	6,014	8,413	10,750	11,898	44,000	See Note

* Estimated

** Total number of different reporting carriers during the 6 year period - NOT the addition of numbers for each year. (For example - Carrier XYZ submitted reports in EACH year but as the "total" reporting carriers, XYZ is only one reporting carrier - not six.)

NOTE: About 10 freight forwarders and 14 other reporters (such as stevedoring firms, Port Authorities, Police, etc.) submitted about 100 HMI reports during this 6 year period.

SOURCE: Materials Transportation Bureau, DOT.

TABLE VII-4

TABULATION OF PROPERTY DAMAGE FIGURES EXCERPTED FROM 32,000 HAZARDOUS MATERIALS INCIDENT REPORTS RECEIVED FROM 1971 THROUGH 1975

Property Damage Shown On HMI Reports	1971 Reports	1972 Reports	1973 Reports	1974 Reports	1975 Reports	Total
$ Over 500,000	1	2	1	3	0	7
$ 500,000	3	0	0	0	0	3
$ 250,000 to $499,999	1	5	3	4	3	16
$ 100,000 to $249,999	3	7	5	7	10	32
$ 50,000 to $ 99,999	18	10	15	8	19	70
$ 25,000 to $ 49,999	44	38	39	36	36	193
$ 10,000 to $ 24,999	68	69	94	99	75	405
$ 5,000 to $ 9,999	38	44	58	60	69	269
$ 2,500 to $ 4,999	34	38	66	87	68	293
$ 1,000 to $ 2,499	68	99	110	179	154	610
$ 500 to $ 999	64	100	133	180	192	669
$ 250 to $ 499	86	131	186	238	490	1,131
$ 100 to $ 249	184	324	492	694	916	2,610
$ 50 to $ 99	176	379	487	791	1,114	2,947
$ 25 to $ 49	195	398	674	928	1,383	3,578
$ 10 to $ 24	250	594	833	1,414	1,887	4,978
$ 1 to $ 9	164	587	858	1,283	1,349	4,241
"0" or blank or shown as "UNKNOWN"	805	1,575	1,946	2,489	3,014	9,829
TOTAL REPORTS	2,200	4,400	6,000	8,500	10,800	32,000

SOURCE: Materials Transportation Bureau, DOT.

TABLE VII-5

LAND SPILL RESPONSE COSTS FOR 4000-GALLON SPILL

Item	Rate ($/hr)	Time Onsite (hr)	Cost ($)
Motorized elevating scraper w/driver	100	4	400
Back hoe w/driver	32	4	128
Vacuum tank trailer	35	4	140
Operator	11	4	44
Tractor	12	4	48
Dump trucks (2)	36	6	216
Operators (2)	22	6	132
Supervisor	16	8	128
Laborer	10	8	80
			1,316

Disposal costs: $1/gallon*

Total cost: $1.00 + \frac{1316}{4000}$ = $1.33/gallon

= $0.16/pound

Source: Estimation of the Frequency and Costs Associated with Cleanup of Hazardous Materials Spills, Preliminary Draft Report to the EPA, April 1978, Arthur D. Little, Inc.

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*Reference: "When the Cop's Shoes Rotted, Disposal Probe Really Started," Boston Sunday Globe, January 29, 1978. Article notes that specialized waste disposal services charge "as high as $1 or more per gallon of waste."

- Disposal of contaminated material;
- Sampling and analysis of underground water supplies;
- Restoration of surface soils.

Spills on land are rarely cleaned up in such a comprehensive manner, but this cost was used because it represents the ideal for spill cleanup. Thus a cost of $1320 was used for cleanup with no incremental reporting cost, since that is already required.

6. Marking

Marking requirements would represent additional costs to truck transporters only. The estimated first-year cost for marking the vehicle as specified in Section 3003 is:

2 hours x $12/hour = $24 in the first year.

Placarding requirements are identical to DOT requirements.

E. SUMMARY OF COMPLIANCE COSTS

The costs of compliance for the process economic model truck transporters of hazardous waste are shown in Table VII-6. Recordkeeping requirements appear here as a fixed charge per truck, although Model 3 may have slightly lower costs due to fewer trips. Recordkeeping associated with the manifest requirements vary with the number of trips and additional driver time required. Thus the cost per truck is lower for Models 1, 2 and 3, which make two trips per day in their respective transportation scenarios, than for Models 4 and 5 where driver time is required to comply.

Registration cost was estimated at $24 for each hazardous waste transport company during the first year. Marking will also require an expenditure of $24 for each truck in the first year (assuming that trucks are not currently marked). To be conservative, a cost of $48 per truck was used for registration and marking combined.

TABLE VII-6

SUMMARY OF COMPLIANCE COSTS WITH RCRA SECTION 3003 FOR TRUCK TRANSPORT

Truck Model	Registration	Recordkeeping	Manifest System	Marking	Total	
					First Year	Recurring
Model 1	$24	$116/year	$ 250/year	$24	$ 414	$ 366
Model 2	24	116/year	250/year	24	414	366
Model 3	24	116/year	125/year	24	289	241
Model 4	24	116/year	1,452/year	24	1,616	1,568
Model 5	24	116/year	1,452/year	24	1,616	1,568

Spill Cleanup: $1,320

SOURCE: Arthur D. Little, Inc., estimates.

EPA estimates[2] that 213 hazardous waste spill incidents occured in 1976. Based on a spill cleanup cost of $1320, this leads to an annual cost of $281,160 for hazardous waste spill cleanup. Since the spill frequency (number of incidents/truck) is unknown, the impact of the cost of spill cleanup has been considered separately from other costs which can be estimated on a per truck or facility basis.

For rail transport, existing bills of lading will be used to meet manifest system requirements. However, additional recordkeeping might be required, and therefore the impact was evaluated of an additional expense of $116 per car per year and $2.00 per trip.

There are no additional compliance activities imposed upon barge transport as a result of Section 3003 standards, provided that current shipping papers or dangerous cargo manifests can be used and no additional recordkeeping or reporting requirements are necessary beyond those which currently exist.

VIII. ECONOMIC IMPACT OF RCRA SECTION 3003

A. APPROACH

As noted in Chapter VI, the transportation of hazardous waste is not an industry but rather a complementary function of other industries. The approach taken to analyze the impact of Section 3003 was to examine the transportation portion of the relevant impacted industries. The three transporter segments analyzed consisted of 1) generators who self-haul to off-site hazardous waste management facilities; 2) for-hire transporters of hazardous waste, and 3) hazardous waste management facilities also engaged in transportation. In addition to a breakdown by class of organization, two modes--rail and truck--were examined.

Two types of analyses were performed. The transportation function itself was analyzed to determine a cost of ownership of a single vehicle over its lifetime, to determine revenue levels for profitable vehicles, or to determine total costs for particular routes and volumes of hazardous waste. A company analysis was used to examine the operation of typical companies for which the transport of hazardous waste was a significant function of business, i.e., for-hire transportation companies and hazardous waste management facilities.

The two types of analyses were used as appropriate for each of the three transporter segments engaged in the transportation of hazardous waste. For generators who self-haul to hazardous waste management facilities, the transportation function is usually a very small portion of company operations. The incremental cost of the transportation function was determined and the costs were discounted over the lifetime of the vehicles.

The generator's transportation functions included both trucking and rail operations.* For trucking operations, the costs of operating a single vehicle both before and after compliance were computed using the truck scenarios outlined in Chapter VII.

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*As the railcars engaged in hazardous waste transport are generally owned by generators, the transport can be considered a function of the generator in the sense that the generator will be responsible for the generator and some transporter compliance requirements.

The rail mode was treated somewhat differently since the amount of hazardous waste transported nationally is a great deal lower than by truck and could be quantified. Spent sulfuric acid is one of the major hazardous wastes shipped by rail. The total cost for transporting spent sulfuric acid by rail was projected for the national volume, based on sample routings. The sample routings, identified in communications with railroads, represented over half of the national volume shipped. (See Appendix E.) In addition to the total cost nationally, two routes, representing a high-cost origin-destination pair and a low-cost origin-destination pair were analyzed to determine total costs, discounted over rail car life. For all three cases, the options of generator leasing and generator purchasing of rail tank cars were considered.

For for-hire transporters, a typical company (assumed to be involved only in hazardous waste transport) was analyzed. Cash flow statements and balance sheets were derived based on the financial profiles of Chapter VI. A company analysis was performed for hazardous waste management facilities also engaged in transportation, based on the financial profiles described in Chapter VI.

The measurement of impact depends on the type of transporter. For generators, the measure of impact was the percent increase in the cost of lifetime transportation of hazardous waste, as well as the increase in lifetime cash flow associated with hazardous waste transport. For hazardous waste management facilities that transport, and for-hire transport, the impact of cost of compliance per vehicle was measured in two ways: the change in profitability that would occur without a rate increase, and the revenues (price increase) needed to maintain the historic internal rate-of-return.

B. FINANCIAL MODELS

Financial models were developed for trucking companies and hazardous waste management facilities engaged in hazardous waste transport. The pro-forma financial statements shown in Chapter VI were used to provide a transportation company financial structure which was input into a financial model (described in Appendix F). A base-line company revenue (and derivative) price was estimated based upon the total cost of operating the company, including allowance for profit, consistent with the after-tax rate-of-return on total capital historically earned by trucking companies (6-7 percent). The price impact of the costs associated with Section 3003 was determined by estimating the revenue (and derivative price) after costs of compliance were added to the model company. The difference between revenue before and after compliance is equivalent to the long-run price increase in hazardous waste transport that will occur as a result of Section 3003 regulations.

To simulate a trucking company over a ten-year period, it is necessary to specify investment schedules and financing. The investment schedule was based upon a uniform age distribution for the 14 vehicles, ranging from 0 (new) to 10 years.[*] Replacement of equipment occurred after ten years, while depreciable life was five years for trailers and eight years for tank units. Financing for vehicles is based upon a four-year chattel loan with 30 percent down payment.

To derive a financial model of hazardous waste management facilities, the pro-forma financial statements shown in Table VI-3 were used along with additional information, as follows:[1]

1977 Average Revenue:	$1.3 million[**]
Average Real Growth:	3 percent per year
Annual Investment:	$183,000 per year

This information represents the hazardous waste management portion of the company. The financial structures of the seven vehicles represent the transportation portion of the company, assumed to be a scaled-down version of the for-hire transportation company.

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[*] Interviews with hazardous waste management facilities indicate some vehicles are up to 20 years old. The uniform age distribution used here does not make any difference from a rate-of-return viewpoint since all vehicles over 8 years old are fully depreciated.

[**] Derived from the 1975 average revenue, excluding transportation shown in Reference 1, allowing for two years of growth.

C. DIRECT IMPACT--VEHICLE MODELS

1. Rail Transport

The direct impact of compliance activities is shown in Table VIII-1, which presents the discounted cost of owning and paying fares for rail cars over twelve years to transport spent sulfuric acid on a high-volume route, a low-volume route, and all routes nationally. Leased car and purchased car alternatives are presented. For rail transport the cost of compliance represents a very small increase in operating costs, with a maximum 0.8 percent increase in the twelve-year costs due to compliance.

2. Truck Transport

The costs of compliance with Section 3003 for each truck model analyzed are shown in Table VIII-2. First-year and recurring-year costs of compliance are shown for each model and compared to pre-compliance annual operating costs. Additionally, the cost of a spill cleanup is compared for each model separately. The increase in operating cost as a consequence of Section 3003 will be greatest for transportation of drummed waste and other waste which the truck operator must manually handle during loading and unloading. This is due to the allocation of additional truck driver's time to obtain certification of delivery. The increase is greater for truck model 5 than for truck model 4, because model 5 has fewer ton-miles per year. Likewise, the impact on truck model 3 is the least because it represents a high annual mileage, long-trip distance scenario. This is the expected result since costs of compliance vary with the number of trips.

The cost of spill cleanup amounts to only 3.2 - 4.7 percent of annual operating cost. The spill frequency per truck for hazardous waste transportation is unknown and thus an expected annual cost could not be derived.

TABLE VIII-1

IMPACT OF RCRA SECTION 3003

REGULATIONS ON RAIL CAR OPERATING COSTS

	PRESENT VALUE OF 12-YEAR OPERATING COST ($000)	
	Leased Car	Purchased Car
National Total		
Before Compliance	$5,545.1	$5,703.3
After Compliance	5,589.8	5,751.8
$ Change	44.7	48.5
% Change	0.8	0.8
Case 1		
Before Compliance	$ 84.6	$ 90.0
After Compliance	85.0	90.4
$ Change	0.4	0.4
% Change	0.5	0.4
Case 2		
Before Compliance	$ 771.3	$ 819.0
After Compliance	776.0	824.7
$ Change	4.7	4.9
% Change	0.6	0.6

Case 1: Low-cost origin-destination pair with annual volume of 1,275 tons

Case 2: High-cost origin-destination pair with annual volume of 9,000 tons

Source: Arthur D. Little, Inc., estimates.

TABLE VIII-2

IMPACT OF RCRA SECTION 3003

REGULATIONS ON TRUCK OPERATING COSTS

Truck Transport Model	No. Trips/Day	Cost of Compliance		Annual Operating Costs[a]	Percent of Operating Costs		Spill Clean-up	
		First Year	Subsequent Years		First Year	Recurring Years	Cost	% Operating Costs
1	2	$ 414	$ 390	$32,500	1.3	1.2	$1,320	4.1
2	2	414	390	28,375	1.5	1.4	1,320	4.7
3	1	289	215	41,500	0.7	0.6	1,320	3.2
4	2	1,616	1,640	34,000	4.9	4.8	1,320	3.9
5	2	1,616	1,640	29,625	5.6	5.5	1,320	4.5

[a] Derived from Chapter VII. Excludes capital costs.

Source: Arthur D. Little, Inc., estimates.

D. DIRECT-IMPACT COMPANY MODELS

The two company financial models, one for a for-hire transporter and one for a waste management facility also engaged in transportation, were analyzed to determine the impact of the cost of compliance with Section 3003.

1. For-Hire Transportation Company

To establish a baseline for gauging impact, pre-compliance revenue consistent with historic for-hire truck company rates-of-return were generated. The revenue required to recover the cost of compliance with Section 3003 was also generated. Table VIII-3 presents the baseline (pre-compliance) revenue and the revenue required to recover the costs of compliance. The pre-compliance price per ton-mile implicit in the model is $0.122 for the 14-truck composite.

The effect of compliance is measured in two ways:

(1) Decrease in return on capital (profitability) in the absence of a price increase; and

(2) Increase in revenues (prices) necessary to recover the cost of compliance, and earn the historic rate-of-return.

In the absence of a price increase, for-hire transporter profitability would decline by 9 percent. However, an increase in revenue of 2.6 percent overall is needed to maintain the same rate-of-return. The impact of compliance upon the for-hire transportation company, assuming a balanced mixture of vehicle types, is between that for the high-impact and low-impact models.

There could be a differential impact upon rates that generators pay if the differential cost impact per truck type or trip is reflected in a relatively higher rate increase for short-haul, low-volume drummed waste transport. This again implies that small waste generators will face a relatively greater increase than larger waste generators, although the increase for both is not great.

TABLE VIII-3

REQUIRED INCREASE IN REVENUE

TO RECOVER COSTS OF COMPLIANCE WITH RCRA SECTION 3003

	Number of Vehicles	Baseline		Required Increase in Revenue		Impact on Profit With No Price Increase	
		Revenue	% ROC[a]	$	% Change	% ROC[a]	% Change
For-hire Transportation Company	14	$ 670,292	6.7	$17,642	2.6	5.7	-9
Hazardous Waste Management Facility	7	1,635,190	15.4	8,800	0.5	15.0	-3

[a] ROC: Return-on-capital.

SOURCE: Arthur D. Little, Inc., estimates.

2. Hazardous Waste Management Company

In addition to the direct costs of owning and operating trucks, hazardous waste management facilities have other expenses and pricing policies which can result in a different impact on rates than that incated by examining trucks above. An increase in truck expenses can be offset by increases in revenues from trucking and/or disposal operations.

The hypothetical hazardous waste management company described in Chapter VI derives 22 percent of its revenues from transportation operations. A change in transportation expenses due to compliance activities will require a smaller increase in total revenues to recover costs than for the for-hire transportation company. The impact of the cost of compliance with Section 3003 can be measured in two ways:

(1) Decrease in return on capital (profitability) in the absence of a price increase; and

(2) Increase in revenues (prices) necessary to recover the cost of compliance, and earn the historic rate-of-return.

Table VIII-3 also shows the impact on hazardous waste management facilities. The increase in revenues necessary to maintain the historic rate-of-return for the company is 0.5 percent, while the decline in profitability is 3 percent. The impact on the hazardous waste management facility is a smaller decrease in profit than for the transportation company because transportation represents only 22 percent of this total.

3. Generators

The total cost of hazardous waste transport for the generator industries identified in Table VI-1 was estimated at between $27.9 million and $230.1 million per year. If the 2.6 percent price increase indicated in Table VIII-3 materializes, the total increase in rates will be between $730,000 and $6,000,000 as a result of Section

3003 hazardous waste transport regulations. The cost of hazardous waste transport will still be a very small portion of the total cost of manufacture or value added and not sufficient to cause a shift between off-site and on-site disposal.

APPENDIX A

STANDARDS APPLICABLE TO TRANSPORTERS OF HAZARDOUS WASTES

federal register

FRIDAY, APRIL 28, 1978
PART IV

THE NATIONAL ARCHIVES OF THE UNITED STATES • 1934

ENVIRONMENTAL PROTECTION AGENCY

■

Standards Applicable to Transporters of Hazardous Wastes

[6560-01]

ENVIRONMENTAL PROTECTION AGENCY

[FRL 878-3]

[40 CFR Part 263]

STANDARDS APPLICABLE TO TRANSPORTERS OF HAZARDOUS WASTE AND PUBLIC HEARING

AGENCY: Environmental Protection Agency.

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency (EPA) issues proposed standards under section 3003 of the Solid Waste Disposal Act (the Act) prescribing procedures for recordkeeping, acceptance of hazardous waste for transport, compliance with the manifest system, delivery of the hazardous waste to a designated facility, spills, and placarding/marking of vehicles. In addition, EPA proposes that all hazardous wastes which meet the Department of Transportation's (DOT'S) definition of a hazardous material be subject to the Federal DOT Hazardous Material Regulations for both interstate and intrastate shipments. DOT is in the process of developing regulations which will include coverage of hazardous wastes. If DOT develops standards similar to those proposed by EPA, the EPA hazardous waste transportation standards will be modified to reflect the DOT Hazardous Materials Regulations or will reference the DOT Hazardous Materials Regulations. These proposed standards are applicable to transporters of hazardous waste, and they are being issued to protect human health and the environment.

EPA will be issuing additional proposed regulations for hazardous waste at a later date. For details concerning dates and hearings on these future proposed regulations see supplementary information.

DATES: Comments requested on or before June 27, 1978. Hearing: First joint hearing with DOT is scheduled for June 20, 1978.

For details concerning for comment due date and hearings on this proposed regulation, see supplementary information.

ADDRESSES: Comments to: Deputy Assistant Administrator for Solid Waste (WH-562), U.S. Environmental Protection Agency, Washington, D.C. 20460. Communications should identify the regulatory docket or notice number, which is Section 3003 for these proposed standards.

Official record for this rulemaking available at: Room 3111D, U.S. Environmental Protection Agency, 401 M Street SW., Washington, D.C. 20460, and is available for viewing from 9 a.m. to 4 p.m., Monday through Friday, excluding holidays.

Hearing: First joint hearing with DOT is scheduled for June 20, 1978, at the Holiday Inn, Old Town, 480 King Street, Alexandria, Va., 703-549-6080.

FOR FURTHER INFORMATION CONTACT:

Mr. Arnie Edelman, 202-755-9187.

SUPPLEMENTARY INFORMATION: Dates—EPA will propose all hazardous waste regulations under Subtitle C during the spring and summer of 1978. Since certain Sections will be ready for proposal ahead of others, EPA will propose each Section as it becomes available. Comments concerning Section 3003 standards would be appreciated by June 27, 1978. However, the comment period for all Sections (3001-3005), will remain open until at least 60 days after the last Section is proposed in the FEDERAL REGISTER. This will enable those who would prefer to comment on all five Sections at the same time to do so. A notice announcing the closing date for all Sections will be published in the FEDERAL REGISTER upon publication of the last Section.

HEARING: Public hearings on all Subtitle C proposed regulations (3001-3005) will be held during the summer of 1978. The dates of the public hearings will be announced in the FEDERAL REGISTER. EPA and DOT plan to hold joint public hearings on these regulations. The first joint hearing with DOT is scheduled for June 20, at the Holiday Inn, Old Town, 480 King Street, Alexandria, Va., 703-549-6080. Additional EPA/DOT hearing dates will be announced in the FEDERAL REGISTER to coincide with the public hearings that will be held on Sections 3001 and 3002.

Oral or written comments may be submitted at the public hearing on these proposed standards. Registration for the hearing will be held between 8:30 and 9 a.m. Requests to participate in the public hearing should be directed to: Ms. Gerri Wyer, Public Participation Officer, Office of Solid Waste (WH-562), U.S. Environmental Protection Agency, Washington, D.C. 20460, 202-755-9157.

FOR FURTHER INFORMATION CONTACT:

Mr. Arnie Edelman, Hazardous Waste Management Division, Office of Solid Waste (WH-565), U.S. Environmental Protection Agency, Washington, D.C. 20460, 202-755-9187.

Subtitle C of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 (Pub. L. 94-580) (hereinafter RCRA), creates a regulatory framework to control hazardous waste. Congress has found that such waste presents "special dangers to health and requires a greater degree of regulation than does non-hazardous solid waste" (Section 1002(b)(5)). Because of the seriousness of this waste problem, Congress intended that the States develop programs to control it. In the event that States do not choose to operate this program, EPA is required to do so.

This rule is one of a series of seven being developed and proposed under Subtitle C to implement the hazardous waste management program. It is important to note the broad definition of solid waste (Section 1004(27)) which encompasses (with a few exceptions) garbage, refuse, sludges, and other discarded materials including liquids, semi-solids, and contained gases from both municipal and industrial sources. Hazardous wastes, which are a subset of all solid wastes, are those which have particularly significant impacts on public health and the environment.

Subtitle C, then, creates a management control system which, for those wastes defined as hazardous, requires "cradle-to-grave" cognizance including appropriate monitoring, recordkeeping, and reporting throughout the system. Section 3001 defines the criteria and characteristics for identifying and listing hazardous wastes. Those wastes which are identified as hazardous by these means are included in the management control system contructed under Sections 3002-3006 and 3010. Those that are excluded will in any case be subject to the requirements being carried out by States under Subtitle D, under which open dumping is prohibited and environmentally acceptable practices are required.

Section 3002 addresses the standards applicable to generators. The Agency does not interpret the intent of Congress to include in this category individual homeowners. Section 3002 requires the creation of a manifest system which will track wastes from the point of generation to their ultimate disposition.

Section 3003 addresses standards affecting transporters of hazardous wastes to assure that wastes are carefully managed during the transport phase. The Agency is exploring opportunities for meshing closely with proposed and current DOT regulations to avoid duplication in this area.

Section 3004 addresses standars affecting owners and operators of hazardous waste storage, treatment, and disposal facilities. These standards define the levels of environmental protection to be achieved by these facilities and provide the criteria against which EPA (or State) officials will measure applications for permits. Facilities on the generator's property, as well as off-site facilities, are covered by these regulations and will require permits. Generators and transporters who do not treat, store, or dispose of hazardous wastes do not need permits.

Section 3005 describes the scope and coverage of the actual permit-granting process for facility owners and operators. Requirements for the permit application, as well as for the issuance and revocation process, are defined by these regulations. Section 3005(c) provides for interim permitted status during the time period in which the Agency or State is reviewing the pending permit applications.

Section 3006 requires EPA to issue guidelines for State programs and procedures by which States may seek both full and interim authorization to carry out the hazardous waste program in lieu of an EPA-administered program.

Section 3010 defines procedures by which any person generating, transporting, owning or operating a facility for storage, treatment, and disposal of hazardous waste must notify EPA of this activity within 90 days of promulgation of regulations defining any hazardous waste (section 3001). Certain States will be authorized to perform this function upon application to the Administrator. It is significant to note that no hazardous waste subject to Subtitle C regulations may be legally transported, treated, stored, or disposed, nor may interim permits be issued, unless this timely notification is given to EPA or a designated State. After this 90-day notification period, transporters will need to comply with 250.32, which requires transporters to obtain an identification code from EPA or an authorized State.

Sections 3001, 3002, 3004, and 3005 standards are expected to be proposed during the summer of 1978. The Agency intends to promulgate final regulations by the fall of 1978 for all of these sections of Subtitle C. However, it is important for the regulated communities to understand that the regulations (sections 3002-5) do not take effect until six months after promulgation. Thus, there will be a time period after final promulgation during which public understanding of the regulations can be increased and those covered by the regulations can prepare to comply. During this same period, notifications required under section 3010 and permit applications required under section 3005 can be distributed for completion by applicants.

Table I appearing below cross references the numbered sections of RCRA to the Subpart designations to be used in the regulations:

TABLE I

Solid Waste Disposal Act.
Subtitle C—Numbering System.
Subpart A—Section 3001 Standards for Criteria, Identification, and Listing of Hazardous Waste.
Subpart B—Section 3002 Standards Applicable to Generators.
Subpart C—Section 3003 Standards Applicable to Transporters.
Subpart D—Section 3004 Standards for Owners and Operators of Treatment Storage, and Disposal Facilities.
Subpart E—Section 3005 Permits for Treatment, Storage, or Disposal.
Subpart F—Section 3006 Guidelines for Authorized State Programs.
Subpart G—Section 3010 Preliminary Notification of Hazardous Waste Activities.

BACKGROUND

In developing these standards for transporters of hazardous waste, the Environmental Protection Agency has solicited comments, data, opinions, and suggestions from the regulated community (i.e., hazardous waste generators, transporters, operators of treatment and disposal facilities), States, and the public on the major issues confronting EPA as part of the regulation development process. This effort has included the publication of an Advance Notice of Proposed Rulemaking (ANPR) 42 FR 22332 (May 2, 1977), a series of 13 public meetings with a total attendance of over 1,000 people, and the review of the draft regulations by representatives from the public, public interest groups, State and local governments, transporters, generators, and disposers of waste. All comments were reviewed and considered by EPA before proposing these standards for hazardous waste transportation.

Compliance with these hazardous waste transportation regulations (which include by reference most of CFR 46 and CFR 49) by no means exempts the transporter from compliance with the requirements of other Federal, State, or local regulations.

Section 3003(a) of the Act directs the Administrator to promulgate regulations establishing standards applicable to transporters of hazardous wastes "as may be necessary to protect human health and the environment." Such standards shall include but need not be limited to recordkeeping, transportation of properly labeled wastes, compliance with the manifest system, and delivery of the hazardous waste only to a permitted facility. Section 3003(b) states that in case any hazardous waste identified or listed by EPA is subject to the Hazardous Materials Transportation Act (88 Stat. 2156; 49 U.S.C. 1801 and following), the Subtitle C regulations promulgated by the Administrator shall be consistent with the Department of Transportation's (DOT's) Hazardous Materials Regulations. The Administrator is authorized to make recommendations to the Secretary of Transportation concerning the regulations of hazardous waste.

The criteria for identifying and listing hazardous waste, as developed under section 3001 of the Act, will take into account toxicity, persistence, degradability in nature, potential for accumulation in tissue, flammability, corrosiveness, and other hazardous characteristics.

Hazardous wastes defined or listed under Section 3001 may include hazardous materials as defined by DOT or "hazardous substances" as defined by EPA under the Federal Water Pollution Control Act. DOT has designated material as hazardous upon finding that the transportation of a material in commerce may pose an unreasonable risk to health and safety or property (49 CFR 171.8). The criteria and testing methods to evaluate whether or not a material is hazardous are found in 49 CFR 173. The following have been designated as classes of hazardous materials by the Secretary of Transportation: Explosives, Combustible Liquids, Corrosive Materials, Flammable Liquids, Flammable Gases, Nonflammable Gases, Flammable Solids, Organic Peroxides, Oxidizers, Poisons, Irritating Materials, Etiologic Agents, and Radioactive Materials.

Regulations defining hazardous substances under Section 311 of the Federal Water Pollution Control Act are found under 40 CFR 116. The Administrator is required to designate hazardous substances that present an imminent and substantial danger to the public health or welfare when discharged in any quantity into or upon the waters of the United States.

EPA AND DOT COORDINATION

The standards set forth under section 3003 are consistent with standards developed under the Hazardous Materials Transportation Act (49 CFR 100-189).

After lengthy discussions between EPA and DOT, DOT has expressed a strong interest in broadening its Hazardous Materials Regulations to include most or all of EPA's proposed hazardous waste regulations. Depending on DOT's actions, EPA may eventually jointly promulgate with DOT, modify these proposed regulations, or adopt forthcoming DOT regulations. EPA and DOT intend to jointly enforce any DOT regulations governing transportation of hazardous waste.

COMPLIANCE WITH U.S. DOT HAZARDOUS MATERIALS REGULATIONS

According to a recent interpretation by the Office of Hazardous Materials Operations (DOT), any material, including waste, which meets the DOT criteria of a hazardous material must be handled according to DOT regulations.

The Office of Hazardous Materials newsletter of April/May 1977 states:

> There have been numerous inquiries to the Office of Hazardous Materials Operations regarding the applicability of the Department's Hazardous Materials Regulations to the Transportation of waste materials. These regulations are structured to apply to any materials that may pose an undue hazard in transportation and, as such, do not differentiate between waste and other than waste materials. If, after processing, a material meets the definition

of a hazardous material, then that material must be classed and shipped in accordance with the requirements prescribed for the hazard associated with the material. Many materials, including those considered waste materials, may have more than one hazard and certain other materials may lose their hazardous characteristics due to processing. A mixture of materials, both waste and other than waste, must be properly evaluated to determine its characteristics, since, after processing, a mixture may become more or less hazardous than it was prior to processing.

The Department's Hazardous Materials Regulations may apply to any material regardless of its end use; the fact that material is considered a waste material does not relieve application of these (DOT) regulations.

DOT's current Hazardous Materials Transportation Regulations only apply to transporters engaged in interstate or foreign commerce and the shippers who use them. However, some intrastate shipments are regulated by States that have adopted the Federal regulations or have similar regulations. In the above cases, the shipper usually is responsible for proper description of the hazardous material, proper labeling, packaging, and placarding.

DOT regulations applicable to transporters are found in the Code of Federal Regulations Title 49, parts 171 (General Information, Regulations, and Definitions); 174 (Carriage by Rail); 175 (Carriage by Aircraft); 176 (Carriage by Vessel); 177 (Carriage by Public Highway). Bulk shipments of hazardous materials by vessel are governed by the following DOT regulations: 46 CFR 30-40 (Tank Vessels); 64 (Marine Portable Tanks); 98 (Bulk Cargos); 148 (Solids in Bulk); and 151 (Unmanned Barges). Each of these standards contains regulations for acceptance of materials for transportation, loading, unloading, handling, storage of hazardous materials, leaking containers, accident/spill reporting requirements, containerization, and detailed requirements for specific classes of hazardous materials.

EPA's proposed regulations require that when a material is both a hazardous waste as defined by EPA and a hazardous material as defined by DOT, the provisions of the U.S. DOT Hazardous Materials Regulations must be complied with for intrastate as well as interstate transportation.

For those hazardous wastes not currently subject to the DOT Hazardous Materials Regulations (primarily toxic materials), EPA recognizes DOT's primary mandate for the development of standards concerning the safety aspects of loading, unloading, and handling of materials in transportation. Since EPA anticipates that DOT will redefine hazardous materials to include all hazardous wastes, EPA has determined that DOT should develop such safety standards.

To the extent that problems are identified by EPA and DOT regarding additional measures needed for safety in transportation for these newly covered wastes, the two Agencies will develop appropriate revisions to the currently anticipated rulemakings. Comments are requested concerning the additional safety measures that may be needed for the safe transportation of these hazardous wastes.

SCOPE OF REGULATIONS

EPA's transportation standards do not apply to every shipment of hazardous waste. They only apply when a manifest is required under regulations to be proposed under Section 3002 of the Act. The manifest is the form used for identifying the quantity, composition, and the origin, routing, and destination of the hazardous waste. A manifest will not be required under Section 3002 for transport on the same premises where the waste is generated, treated, stored, or disposed. In such cases, the waste must be properly labeled, contained, treated, stored, or disposed.

Even though a manifest is not required for certain shipments of hazardous waste, transporters who consolidate shipments of hazardous wastes are required under Section 250.30 to deliver the shipment to a permitted facility. In addition such transporters must comply with the applicable DOT Hazardous Materials Regulations concerning shipping papers, labeling, marking, placarding and transportation (49 CFR 100-189).

IDENTIFICATION CODE

Section 250.32 of these regulations will require that every transporter of hazardous waste must furnish information to EPA or an authorized State concerning its hazardous waste transportation activity. Upon submission of this information, the transporter will be issued an identification code. The identification code will in most cases be identical to existing codes assigned to transporters by Federal or State agencies. Generators and shippers of hazardous waste will not be permitted to use transporters who do not have such code. The identification code should not be construed as either a seal of approval by EPA or the issuance of a license or permit.

RECORDKEEPING

Section 3003 of the Act requires that records be kept concerning hazardous waste transported and its origin and destination. In current transport practice, records are often kept (as required by the State public utility commissions or public service commissions and the Interstate Commerce Commission) in the forms of bills of lading, waybills, or invoices. These documents include the following information: the shipper's name and address; the transporter's name and address; the consignee; the quantity of the material; and a description of the material.

To avoid duplication, EPA has tailored its recordkeeping requirements to the existing shipping papers. The Agency requires that a record be kept indicating the origin and destination of each shipment of the waste, the date of pick-up, quantity of waste transported, a description of the waste and a certification that the waste has been transferred to another transporter or delivered to a permitted facility. In most cases, the record will be a copy of the manifest or "delivery document" with the above information. (EPA uses the term delivery document to refer to all forms of shipping papers which contain the above information.) The transporter is required to retain a copy of this record for a three-year period.

ACCEPTANCE OF HAZARDOUS WASTE FOR TRANSPORT

Under the Hazardous Materials Regulations, a transporter cannot accept a hazardous material for transport unless it is properly described, labeled, packaged, and placarded. EPA has developed similar shipping and acceptance regulations for hazardous wastes. Under regulations to be proposed under section 3002 of the Act, the generator is required to certify that the hazardous waste is properly prepared for transportation.

As a service to the generator, the transporter may prepare a manifest (the generator must sign the certification), label, and package the hazardous waste. However, since the generator is responsible for these functions under Section 3002 of the Act, the generator may arrange with the transporter to privately indemnify the generator against financial loss due to improper performance.

LOADING AND STOWAGE FOR TRANSPORTATION

For substances which are both hazardous materials under DOT regulations and hazardous wastes under EPA regulations, EPA in Section 250.30 has adopted DOT regulations regarding loading and stowage. These regulations will apply to intrastate as well as to interstate transportation.

Mixing of wastes which results in the generation of gases, explosion, or fire is prohibited by DOT regulations (which are adopted by reference in Section 250.34). If other hazardous wastes from different generators or separate wastes from the same generator are mixed, and the manifest no longer identifies the composition of the waste shipment, the transporter will be considered a generator, and therefore required to comply with the standards for generators as contained in Subpart B.

COMPLIANCE WITH THE MANIFEST

The manifest system developed under Section 3002 of the Act is intended to track the movement of the hazardous waste from the generator to the ultimate disposal site. A manifest need not accompany the shipment of hazardous waste if information contained on the manifest accompanies it in another form, e.g., a bill of lading or hazardous material shipping paper. Signatures on the manifest or delivery document will certify the transfer of the hazardous waste from the generator to the transporter(s), and finally, acceptance by the hazardous waste management facility.

If the transporter of the waste transfers it to another transporter using a different mode of transportation or, with respect to air and highway, between different transporters using the same mode, the manifest or the delivery document will require the signature of each transporter.

Upon delivery, one copy of the signed manifest or delivery document is retained by the transporter; another copy is forwarded by the hazardous waste management facility to the generator.

DELIVERY OF HAZARDOUS WASTES

The transporter must deliver all hazardous waste to a permitted hazardous waste management facility designated by the generator. If the transporter removes the hazardous waste from the transport vehicle and stores, consolidates or mixes it with another waste, the transporter will be required to comply with standards developed under Sections 3002 and 3004 and receive a permit for the facility from EPA or an authorized State.

Prior to acceptance of the hazardous waste, the transporter should contact the facility designated by the generator to determine its operating hours. Deliveries of hazardous waste to facilities after operating hours should be avoided.

If, for any reason the waste management facility cannot accept the hazardous waste, the transporter should ask the generator whether the hazardous waste shipment should be returned or delivered to an alternative facility. (Under Section 3002 of the Act, EPA intends to allow the generator of the hazardous waste to specify in advance alternative facilities on the manifest.) The transporter should provide advance notice to the alternate facility prior to taking the waste shipment there.

SPILLS

These regulations provide for the expeditious handling of a spill of a hazardous waste or a hazardous material (which, when spilled, becomes a waste). When a spill requires immediate removal (as determined by EPA, other Federal Agencies, or a State or local authorized official), due to a threat of imminent hazard to human health or the environment, EPA's standards concerning identification codes for transporters, recordkeeping, acceptance of the hazardous wastes, compliance with the manifest, delivery to the designated facility, and placarding and marking of vehicles will be suspended until the spill is cleaned up, rendered non-hazardous, or determined to no longer present an imminent hazard to human health or the environment (as determined by EPA, other Federal Agencies, or a State or local authorized official). When a spill occurs, these proposed standards require the transporter to: (a) telephone the National Response Center (NRC); (b) file a written report on the spill to the DOT using the DOT Hazardous Materials Incident Report; and (c) clean up the spill, or take such action as may be required by Federal, State, or local agencies so that the waste no longer presents a hazard to human health or the environment.

EPA is proposing the use of the existing 24-hour emergency NRC phone number for telephone calls relating to hazardous waste spills. Once the NRC is notified, the appropriate Federal and State agencies will be contacted. (Transporters may also be subject to State telephone notification requirements in the event of a spill.) Every spillage of a hazardous waste during transportation regardless of quantity will require a telephone contact to the NRC.

EPA has adopted 49 CFR 171.16 to govern the written reporting of hazardous waste spills. Title 49 CFR 171.16 requires a transporter of hazardous materials to report in writing within 15 days to the U.S. Department of Transportation each incident (including spills) that occurs during the course of loading, transport, or unloading.

Spill reports are important to allow EPA to evaluate current regulations concerning the handling and packaging of hazardous wastes and monitoring of environmental damage. In filling out the DOT Hazardous Materials Incident Report, the transporter should indicate if the spilled hazardous waste entered a water body, public drinking water supply or groundwaters, destroyed vegetation or wildlife, or produced any other harmful effects on the environment. The transporter should also estimate the total quantity of the material removed from the spill site and describe its final disposition. If it was delivered to a permitted hazardous waste management facility, the permit number should be included. If any residual remains, the quantity should be estimated and the transporter should describe any actions taken to reduce the hazardousness of the waste, including actions required by Federal, State, or local agencies.

MARKING OF VEHICLES

The ICC and DOT currently require motor vehicles involved in the interstate transport of hazardous materials to be marked with the name and home office of the transporter. EPA has adopted this requirement for all hazardous waste transporters whose vehicles require DOT placarding or carry more than 1,000 pounds of hazardous waste. If there is an emergency and the manifest or delivery document is not available, such marking enables the public or emergency response personnel to contact the transporter's home office to determine the contents of the shipment.

PLACARDING OF VEHICLES.

For hazardous wastes which meet DOT's definition of a hazardous material, EPA has adopted existing DOT placarding requirements. Vehicles containing certain hazardous wastes which are toxic, bioaccumulative, carcinogenic, or may cause genetic change are not now required to be placarded by DOT. EPA is considering recommending to DOT the development of a new placard for such substances. Comments on the need for such a placard are requested.

PERMITTING TRANSPORTERS

Several States, public interest groups, waste management representatives, and transporters recommended that a permitting system for transporters of hazardous wastes be developed by EPA. Such a permitting system would serve two purposes: to identify and collect data on hazardous waste transporters, and to enable the permitting agency to revoke the permit in the event of misconduct.

After reviewing the legislative history of the Solid Waste Disposal Act, EPA has found no Congressional intent to authorize it to require a permit system for transporters. Although section 3003 generally calls for promulgating "regulations establishing such standards applicable to transporters of hazardous waste identified or listed under this subtitle, as may be necessary to protect human health and the environment," Section 3005, which sets out the permit requirements, is directed only toward owners and operators of facilities for the treatment, storage, or disposal of hazardous waste, and not toward transporters. Moreover, the States and the Interstate Commerce Commission currently regulate (often by permit) many transporters of hazardous wastes directly. Therefore, at this time, EPA will not develop an EPA transporter permitting program.

REFERENCES TO SECTION 3002 STANDARDS

In the following proposed standards, references are made to the standards being developed for a manifest system and for labeling practices under section 3002.

Section 250.22 describes standards for the manifest system. The manifest is designed to provide information on the movement of hazardous waste from the point of generation to the designated permitted hazardous waste management facility. To be consistent with DOT requirements for hazardous materials, EPA requirements are similar to the DOT shipping paper requirements. The manifest is envisioned as a shipping document that does not leave commercial channels and takes the basic form of the standard Bill of Lading.

Section 250.26 describes standards for labeling containers of hazardous wastes. Any hazardous waste which is also a DOT hazardous material must be labeled and marked in accordance with the DOT regulations. In addition to the DOT requirements, EPA is considering a marking that will identify the generator and (for individual packages) the manifest number for the shipment of hazardous waste.

A reporting impact analysis is being performed for the substantive environmental regulations to be published under RCRA Subtitle C, Hazardous Waste Management in conjunction with a data processing system feasibility study. These proposed standards will require the transporter, in the event of a spill of hazardous waste, to telephone the NRC and submit a written report to DOT. The written report uses the existing DOT Hazardous Materials Incident Report with supplemental information required. It is anticipated that cost for compliance is minimal. The cost of the report preparation (clerical and management) and phone notification is estimated to be no more than $100 per year per vehicle involved in a spill of hazardous waste.

ECONOMIC AND ENVIRONMENTAL IMPACTS

In accordance with Executive Order 12044 and 11821 as amended by Executive Order 11949, and OMB Circular A-107 and EPA policy as stipulated in 39 FR 37419, October 21, 1974 respectively, analyses of the economic and environmental impacts are being performed for the entirety of Subtitle C, Hazardous Waste Management, and are not completed as yet. However, a separate report on the cost of compliance with section 3003 proposed standards has been prepared. It is anticipated that the cost of compliance is minimal due to the extent of existing ICC, DOT, and State regulations; and the nature of the transport activity, which includes significant loading and unloading times, during which manifest compliance activities can usually be accomplished.

The Draft EIS will be released for public comment 30 days after the last Subtitle C regulation is proposed. Copies of the EIS and the economic analysis will be available for review through the Office of Solid Waste.

Dated: April 21, 1978.

BARBARA BLUM,
Acting Administrator.

Title 40, Code of Federal Regulations, Part 250 would be amended, by adding a Subpart C consisting of §§ 250.30-250.38 as follows:

PART 250—HAZARDOUS WASTE GUIDELINES AND REGULATIONS

Subparts A-B—[Reserved]

Subpart C—Standards Applicable to Transporters of Hazardous Wastes

Sec.
250.30 Scope.
250.31 Definitions.
250.32 Identification code.
250.33 Recordkeeping.
250.34 Acceptance and transport of hazardous waste.
250.35 Compliance with the manifest.
250.36 Delivery of hazardous wastes to a designated permitted facility.
250.37 Spills.
250.38 Placarding/marking of vehicles.

Subparts D-F—[Reserved]

* * * * *

Subpart G—[Reserved]

AUTHORITY: Secs. 2002(a) and 3003, Pub. L. 94-580, 90 Stat. 2804, 2807 (42 U.S.C. 6912, 6923).

§ 250.30 Scope.

(a) These regulations establish standards which apply to any person or Federal agency that transports hazardous waste within the United States which requires a manifest as specified under subpart B of this part or any transporter importing a shipment of hazardous waste from abroad. If a manifest is not required, any person or Federal agency that consolidates for shipment and transports hazardous waste shall deliver the entire quantity of hazardous waste(s) to a facility permitted under subpart E of this part and shall comply with the DOT regulations listed in 250.30(c).

(b) These regulations do not apply to persons or Federal agencies that transport hazardous waste(s) on the site of a hazardous waste generator or permitted hazardous waste management facility.

(c) If hazardous waste identified or listed under subpart A of this part also meets the definition and criteria for hazardous materials of the Department of Transportation (49 CFR 171.8 and 173), the following regulations of the Department of Transportation will apply for both intrastate and interstate transportation: 49 CFR 171, General Information, Regulations, and Definitions; 49 CFR 174, Carriage by Rail; 49 CFR 175, Carriage by Aircraft; 49 CFR 176, Carriage by Vessel; 49 CFR 177, Carriage by Public Highway; 46 CFR 30-40, Tank Vessels; 46 CFR 64, Marine Portable Tanks; 46 CFR 98, Bulk Cargos; 46 CFR 148, Solids in Bulk; and 46 CFR 151, Unmanned Barges.

§ 250.31 Definitions.

For purposes of this part, all terms not herein defined shall take the meaning given them by the Solid Waste Disposal Act (Pub. L. 94-580).

(a) "Delivery document" means a shipping paper (bill of lading, waybill, dangerous cargo manifest, or other shipping document) used in lieu of the orginal manifest to fulfill the recordkeeping requirement of § 250.33.

(b) "Generator" means any person defined as a generator in regulations under subpart B of this part.

(c) "Hazardous material" means a substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated under 49 CFR 171.8 and 173.

(d) "Identification code" means the unique code assigned to each transporter of hazardous waste by EPA or an authorized State upon notification in accordance with subpart G of this part or upon compliance with § 250.32 of this subpart.

(e) "Manifest" means the form used for identifying the quantity, composition, and the origin, routing and destination of hazardous waste as specified in regulations under § 250.22, subpart B of this part.

(f) "Mode" means any of the folowing transportation methods: Rail, highway, air, or water.

(g) "Motor vehicle" means a vehicle, machine, tractor, trailer, or semitrailer, or any combination thereof, propelled or drawn by mechanical power and used upon the highways in transportation. It does not include a vehicle, locomotive, or car operated exclusively on a rail or rails.

(h) "On the site" means on the same or geographically contiguous property. Two or more pieces of property which are geographically contiguous and are divided only by public or private right(s)-of-way are considered a single site.

(i) "Permitted hazardous waste management facility" (or "permitted facility") means a hazardous waste treatment, storage, or disposal facility that has received an EPA permit in accordance with the requirements of subpart E of this part or a permit from an authorized State agency.

(j) "Spill" means any accidental discharge of a hazardous waste onto or into the land or water.

(k) "Transporter" means a person or Federal agency engaged in the transportation of hazardous waste by air, rail, highway, or water.

(l) "Transport vehicle" means a motor vehicle, rail freight car, freight container, cargo tank, portable tank, or vessel (as defined in 49 CFR 171.8) used for the transportation of hazardous waste.

(m) "United States" means the 50 States, District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands.

§ 250.32 Identification code.

Any transporter who transports or intends to transport hazardous waste within the United States shall comply with §§ 250.822 and 250.823 to obtain an identification code from the Environmental Protection Agency or an authorized State. The identification code issued shall be included on:

(a) The manifest (§ 250.22);

(b) The hazardous materials incident report (§ 250.37); and

(c) The delivery document (§ 250.35(c)).

§ 250.33 Recordkeeping.

Each transporter shall maintain a copy of the manifest or delivery document for a period of not less than 3 years from date of either transfer of the hazardous waste to another transporter or delivery of the hazardous waste to a permitted facility as indicated on the manifest or the delivery document.

§ 250.34 Acceptance and transport of hazardous waste.

(a) A transporter shall not accept from a generator a shipment of hazardous waste without a manifest signed by the generator in accordance with the provisions of § 250.22.

(b) A transporter shall not transport a shipment of hazardous waste from a generator without signing the manifest acknowledging acceptance of the hazardous waste shipment.

(c) If a shipment of hazardous waste is transported by more than one transporter, subsequent transporters shall not accept for transport or transport the hazardous waste shipment without a manifest or shipping document that contains the information on the manifest in accordance with the provisions of § 250.22.

(d) A transporter shall not transport a shipment of hazardous waste in containers not properly labeled or marked in accordance with the provisions of § 250.26:

(1) If the DOT label is lost or detached, the transporter must replace that DOT label in accordance with the provisions of § 250.26.

(2) The DOT replacement label must be based on the information taken from the manifest covering the shipment.

(e) A transporter shall not transport containers which are leaking or appear to be damaged. In the event that leakage develops or is discovered during transportation and the leakage results in a spill, the transporter shall comply with 250.37.

(f) A transporter shall not accept or consolidate hazardous waste(s) consisting of a material or mixture of materials that is prohibited from transportation by 49 CFR 173.21.

§ 250.35 Compliance with the manifest.

(a) Each transporter shall assure that a copy of the manifest or the information contained on the manifest (in the form of, e.g., a hazardous materials shipping paper, bill of lading, waybill) at all times accompanies the shipment of hazardous waste.

(b) If the hazardous waste shipment is transferred between the different modes (air, rail, highway, or water) or between different transporters using the air or highway mode, each transporter and each subsequent transporter shall sign the manifest or delivery document acknowledging acceptance of the shipment before the hazardous waste can be transported.

(c) The delivery document shall:

(1) Contain as a minimum, the following information:

(i) Name, address of transporter;

(ii) Name, address, identification code of generator;

(iii) Name, address, identification code of designated permitted facility;

(iv) Corresponding manifest document number; and

(v) Description and quantity of hazardous waste.

(2) Only be used when the original manifest is not with the shipment of hazardous waste.

(d) The transporter shall, upon delivery of the hazardous waste to the designated permitted facility, obtain the signature of an authorized agent of the permitted facility on the manifest or delivery document certifying delivery.

(1) If a delivery document is used in lieu of the manifest, the transporter shall issue three copies of the delivery docuent to the designated permitted facility for signature. The transporter shall retain one of the signed copies as required by 250.33.

(2) If the transporter cannot acquire immediate certification, the transporter shall:

(i) Indicate on the manifest or delivery document the following:

(A) Time and date of delivery; and

(B) Reason manifest or delivery document could not be certified upon delivery; and

(ii) Acquire certification on the manifest or delivery document by an authorized agent of the permitted facility as soon as possible, but not to exceed 5 working days after delivery of the shipment.

§ 250.36 Delivery of hazardous wastes to a designated permitted facility.

(a) The transporter shall deliver the entire quantity of hazardous waste(s) accepted from a generator or a transporter to a permitted facility designated by the generator on the manifest.

(b) If the transporter removes the hazardous waste from a transport vehicle or aircraft for purposes of blending, mixing, treating, or storing, the blending, mixing, treating, or storing shall be done at a permitted facility.

(c) If hazardous wastes from different generators or separate wastes from the same generator becomes mixed after having been accepted by the transporter, the transporter shall comply with the generator standards under subpart B of this part unless the transporter can demonstrate that the information designated on the manifest(s) under § 250.22 (a) (5), (6) of subpart B of this part still identifies the hazardous waste.

§ 250.37 Spills.

(a) If a spill of hazardous waste requires immediate removal to protect human health or the environment (as determined by EPA, other Federal agencies, or a State or local authorized official), the requirements of this section shall apply in lieu of §§ 250.32, 250.33, 250.34, 250.35, 250.36, and 250.38 of this subpart until the spilled hazardous waste no longer presents an immediate hazard to human health or the environment (as determined by EPA, other Federal agencies, or a State or local authorized official).

(b) In the event of any spill of hazardous waste during transportation, the transporter shall:

(1) Telephone immediately:

(i) The National Response Center, U.S. Coast Guard, toll free, 800-424-8802; or

(ii) The government official predesignated in the applicable regional contingency plan pursuant to 40 CFR 1510 as the on-scene coordinator for the geographic area in which the incident occurs.

(2) Furnish the following information upon notification:

(i) Name of person reporting the spill;

(ii) Name and address of transporter;

(iii) Name and address of generator;

(iv) Phone number where reporter can be contacted;

(v) Date, time, and location of incident, (indicate pollution of land, water, air, or public water supply, if known);

(vi) Type of transport vehicle and mode;

(vii) Type of incident (e.g., fire, breakage, spillage);

(viii) Classification, name, and quantity of hazardous waste involved, to the extent available; and

(ix) The extent of injuries, if any.

(3) File within 15 days a written report in duplicate with the Director, Office of Hazardous Materials Operations, Materials Transportation Bureau, Department of Transportation, Washington, D.C. 20590, on each spill that occurred during the course of transportation. DOT form F 5800.1 [1] shall be utilized as a basic reporting document; item A 1.6 shall be filled in as "waste"; item B4 shall include the transporter's identification code. In addition under part H of DOT form 5800.1, the following information shall be included:

(i) If known, location of spill in relation to surface waters, public water supply, groundwater, wildlife habitats, and agricultural production areas;

(ii) Quantity of material removed and disposition of the material; and

(iii) Disposition and quantity of unremoved material.

(c) The transporter shall clean up all the spilled hazardous waste or take such action as may be required by Federal, State, or local agencies so that the spilled hazardous waste no longer presents a hazard to human health or the environment.

§ 250.38 Placarding/marking of vehicles.

(a) A transporter shall not move a transport vehicle containing hazardous waste which is also a DOT hazardous material unless it is placarded in accordance with 49 CFR 172, subpart F. This prohibition applies to both intrastate and interstate transportation.

(b) A transporter shall mark each motor vehicle being operated under its own power for the transportation of hazardous waste if the motor vehicle is required to be placarded or if the motor vehicle contains greater than 1,000 pounds of hazardous waste. The marking shall display the following information:

(1) Name of transporter under whose authority the vehicle is being operated; and

(2) The city or community in which the carrier maintains its principal office or in which the vehicle is customarily based.

(i) The marking must:

(A) Appear on both sides of the vehicle;

(B) Be in letters that contrast sharply in color with the background; and

(C) Be readily legible during daylight hours from a distance of 50 feet while the vehicle is stationary.

(ii) The marking may consist of a removable device meeting the above identification requirements.

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[1] DOT form F 5800.1 is filed as part of the original document and available from the Office of Hazardous Materials Operations, Materials Transportation Bureau, Department of Transportation, Washington, D.C. 20590.

APPENDIX B

ORGANIZATIONS FURNISHING INFORMATION

(IN ADDITION TO THOSE LISTED IN
TABLES II-1 AND II-2)

APPENDIX B-1

RAIL CARRIER SEGMENT

Railroads

Southern Pacific Railroad
San Francisco, California

Missouri Pacific Railroad
St. Louis, Missouri

Southern Railroad
Atlanta, Georgia

The Chessie System
Baltimore, Maryland

Disposers and Reclaimers

ENSCO
El Dorado, Arkansas

SCA/Chem-Trol
Model City, New York

Rollins Environmental Services, Inc.
Houston, Texas

Solvents Recovery Service of New Jersey, Inc.
Linden, New Jersey

Industrial Tank, Inc.
Martinez, California

Merichem Co.
Houston, Texas

Stouffer Corp.
Alabama, Texas, & Ohio

Others

Bureau of Explosives
Association of American Railroads
Washington, D.C.

Schneider Tank Lines
Neenah, Wisconsin

Texas City Terminal Railway
Company
Texas City, Texas

Military Traffic Management
Command
Department of Defense
Washington, D.C.

Director of Transportation
U.S. Air Force
Washington, D.C.

Ethyl Corp.
Louisiana

APPENDIX B-2

FOR-HIRE MOTOR CARRIER SEGMENT

Advanced Pollution Control Corp.
Braintree, Massachusetts

Area Sanitary Service
Monticello, Indiana

Charles George Trucking Company, Inc.
Tyngsboro, Massachusetts

Chemical Leaman
Downingtown, Pennsylvania

Darrel H. Wright Trux
Jamestown, Colorado

Davis Transport Company
Paducah, Kentucky

FPR Bohager and Sons, Inc.
Baltimore, Maryland

General Drainage
Gary, Indiana

Glazer Scrap Corporation
Richmond, Indiana

Groendyke Transport, Inc.
Enid, Oklahoma

Independent Waste Systems, Inc.
Gary, Indiana

Inland Pumping and Dredging Co.
Downingtown, Pennsylvania

Jones Chemicals, Inc.
Beech Grove, Indiana

Keefe Trucking Company
Portsmouth, New Hampshire

Liberty Waste Disposal
Baytown, Texas

Liquid Removal Service Company, Inc.
Broomall, Pennsylvania

Maryln Engineering Corporation
Boston, Massachusetts

Matlack, Inc.
Lansdowne, Pennsylvania

M.E. Trucking Company
Detroit, Michigan

Mister Frank, Inc.
South Holland, Illinois

McKay Trucking Company
Coalinja, California

Oilfields Trucking Company
Bakersfield, California

Powell Sanitation
Oklahoma City, Oklahoma

Rainbow Truck Company
Long Beach, California

Reiss Envirochem, Inc.
Sheboygan, Wisconsin

Schneider Tank Lines
Neenah, Wisconsin

Scrap Haulers of Riverdale
Riverdale, Illinois

Snow Environmental Services
Marcus Hook, Pennsylvania

Tappan Tanker Terminal, Inc.
Hastings on the Hudson, New York

The Liquidator, Inc.
Everett, Massachusetts

APPENDIX B-2 (Cont.)

United Pumping Service
El Monte, California

Valley Industrial Pumping
San Jose, California

Van't Tank Truck Service
Marine City, Michigan

Waste Transport Company
Adams City, Colorado

APPENDIX B-3

WATER CARRIER SEGMENT

American Commercial Barge Lines
Jeffersonville, Indiana

B and M Towing Company
Houston, Texas

Canal Barge Company
New Orleans, Louisiana

Chotin Transport, Inc.
New Orleans, Louisiana

Dixie Carriers
Houston, Texas

Marine Transport Company
St. Louis, Missouri

Merichem Company
Houston, Texas

U.S. Coast Guard
Department of Transportation
Washington, D.C.

APPENDIX B-4

AIR CARRIER SEGMENT

Air Line Companies

American Airlines
New York, New York

Blackhawk Air Service, Inc.
Rock Falls, Illinois

Blackhawk Airways, Inc.
Jonesville, Wisconsin

Federal Express Corporation
Memphis, Tennessee

Flying Tiger Line, Inc.
Los Angeles, California

Ozark Air Lines, Inc.
St. Louis, Missouri

Seaboard World Airlines, Inc.
Jamaica, New York

United Air Lines, Inc.
Chicago, Illinois

Associations

Air Freight Forwarders Association
of America
Washington, D.C.

Air Line Pilots Association,
International
Washington, D.C.

Air Transport Association
of America
Washington, D.C.

National Air Transportation Associations
Washington, D.C.

Other

Airport Control Tower
Longview, Texas

CFE Air Cargo, Inc. (Ground Handler)
Norfolk, Virginia

Department of Defense:
  Director of Transportation,
    U.S. Air Force
  Military Airlift Command
  Military Traffic Management Command

Department of Transportation
  Federal Aviation Administration
  Washington, D.C.

Profit by Air, Inc.
Springfield Gardens, New York

Shulman Transport Enterprises
Cherry Hill, New Jersey

APPENDIX B-5

PIPELINE SEGMENT

American Petroleum Institute
Washington, D. C.

Department of the Army
Corps of Engineers
Washington, D. C.

Asarco, Inc.
New York, New York

Bechtel Corporation
San Francisco, California

Black Mesa Pipeline
Los Angeles, California

Buckeye Pipe Line Company
Radnor, Pennsylvania

Cleveland Regional Sewer Authority
Cleveland, Ohio

Colonial Pipeline Company
Atlanta, Georgia

Consolidated Edison Company
of New York, Inc.
New York, New York

Consolidation Coal Company

Dravo Corporation
Pittsburgh, Pennsylvania

Gulf Coast Waste Disposal Authority

Intercomp Resource Development and
Engineering, Inc.
Houston, Texas

Kennecott Copper Corporation
New York, New York

Los Angeles County Office of Sanitation
Los Angeles, California

Metropolitan Sanitary District of
Greater Chicago
Chicago, Illinois

Oklahoma State Development of Health,
Industrial, and Solid Waste Management Div.
Oklahoma City, Oklahoma

Slurry Transport Association
Washington, D. C.

U. S. Department of Transportation
Office of Pipeline Safety
Washington, D. C.

William J. Lamberton
Tulsa, Oklahoma

APPENDIX B-6

GENERATOR SEGMENT

A&K Materials Company
Oklahoma City, Oklahoma

Aerojet Solid Propellant
Sacramento, California

Air Products and Chemicals
Oklahoma City, Oklahoma

Aladd Pest Control Company, Inc.
Oklahoma City, Oklahoma

AMF Tuboscope
Edmond, Oklahoma

Amtekco Industries, Inc.
London, Ohio

APW Company, Inc.
Rockaway, New Jersey

Arapahoe Chemicals Inc.
Boulder, Colorado

Atco Termite and Chemicals
Tulsa, Oklahoma

Augusta Bag & Burlap Company
Augusta, Georgia

Avril G.A. Company
Cincinnati, Ohio

Bibb Manufacturing Co.
Columbus, Georgia

Bona-Allen
Buford, Georgia

Continental Oil Co.
Denver, Colorado

Cook Paint and Varnish Co.
Kansas City, Missouri

Dorchester Gas Producing Company
Hooker, Oklahoma

Dow Chemical Company
Midland, Michigan

E.I. DuPont de Nemours & Co.
Deepwater, New Jersey

E.I. DuPont de Nemours & Co.
Wilmington, Delaware

Eastman Kodak
Rochester, New York

Electra-Power, Inc.
Cincinnati, Ohio

Eli Lilly
Clinton, Indiana

Ethyl Corp.
Baton Rouge, Louisiana

FMC Corporation
Philadelphia, Pennsylvania

General Motors
Warren, Michigan

B. F. Goodrich
Cleveland, Ohio

Greenfield Tap & Die
Greenfield, Massachusetts

Henny Penny Corp.
Easton, Ohio

Johns Manville Sales Corp.
Denver, Colorado

Linde Division
Union Carbide Corp
Tulsa, Oklahoma

APPENDIX B-6 (Cont.)

Majestic Lubricating Company
Tulsa, Oklahoma

Mapco, Inc.
Tyrone, Oklahoma

Mary Carter Paints
Wheeling, Illinois

Monsanto Industrial Chemical Co.
St. Louis, Missouri

Moore Chrome Products Co.
Toledo, Ohio

National Cylinder Gas
Chemetron Corporation
Oklahoma City, Oklahoma

Olin Corporation
New Haven, Connecticut

Osborne Hosiery Company
Dallas, Georgia

Pfizer, Inc.
Groton, Connecticut

Prime Tanning
Berwick, Maine

Rockport Machine and Tool Co.
Lakewood, Ohio

Roisman Drug Sundries, Inc.
Oklahoma City, Oklahoma

Rubicon Chemical
Geismar, Louisiana

Schill Pattern Company
Toledo, Ohio

Sharp Industries, Inc.
Somerdale, New Jersey

Sherwin Williams,
Cleveland, Ohio

Smith Electro Chemical Co.
Cincinnati, Ohio

Stauffer Chemical Co.
Westport, Connecticut

Sylvania GTE
Danvers, Massachusetts

Talon Zipper
Meadville, Pennsylvania

Thomas Enterprises
Tulsa, Oklahoma

3M Company
St. Paul, Minnesota

Union Carbide
Institute, West Virginia

APPENDIX B-7

HAZARDOUS WASTE MANAGEMENT FACILITY SEGMENT

A-1 Disposal, Inc.
Plainwell, Michigan 49080

American Chemical Service
Griffith, Indiana 46319

Approved Chemical Treatment
Grand Rapids, Michigan 49608

Approved Industrial Removal
Grand Rapids, Michigan

Big 3 Enterprises
Kansas City, Missouri 64101

Browning-Ferris, Inc.
Houston, Texas 77025

By-Products Management, Inc.
Schererville, Indiana 46375

Chem-Met Services
Wyandotte, Michigan

Chem-Nuclear Systems, Inc.
Portland, Oregon 97207

Chemical Processors, Inc.
Seattle, Washington 96108

Chemical Recovery Systems, Inc.
Romulus, Michigan 48174

Chemical Waste Management
Calumet City, Illinois

Chemline Corporation
Ohio Industrial Wastes Division
Lisbon, Ohio

Conservation Chemical Co.
Gary, Indiana 46406

Dearborn Refining Company
(Phillips Waste Oil Pickup)
Dearborn, Michigan 48121

Earth II
Chicago, Illinois 60617

Edwards Waste Oil & Road Oiling Service, Inc.
Detroit, Michigan

Environmental Waste Control, Inc.
Inkster, Michigan 48141

Erieway Pollution Control
Bedford, Ohio 44146

Fisher-Kalo Chemical & Solvent Corp.
Kingsbury, Indiana

Gaess Environmental Services
Division of SCA Services, Inc.
Passaic, New Jersey

General Oil Co., Inc.
Detroit, Michigan 48239

Gulf Coast Waste Disposal Authority
Houston, Texas

Hammond Septic Tank Service
East Leroy, Michigan

Hartley and Hartley, Inc.
Kawkanlin, Michigan 48631

IWD Liquid Waste Incorporated
Dayton, Ohio 45414

Industrial Liquid, Waste Disposal Co.
Columbus, Indiana

Interstate Pollution Control
Rockford, Illinois 61101

Jacobusse's Refuse Service Co.
Holland, Michigan 49423

Koski Construction Co.
Ashtabula, Ohio

APPENDIX B-7 (Cont'd.)

William J. Lamberton
Tulsa, Oklahoma

Liqwacon Corporation
Thomaston, Connecticut

The Major Oil Co., Inc.
Romulus, Michigan 48174

Malone Company
Texas City, Texas 77590

Metro Tank Service
Warren, Michigan 48093

Michigan Petroleum
Detroit, Michigan 48212

Nelson Chemicals Co.
Detroit, Michigan 48227

Newco Chemical Waste Systems, Inc.
Niagara Falls, New York
(Braintree, Massachusetts Div.)

Nuclear Engineering Co., Inc.
San Ramon, California 94583

Ohio Liquid Disposal, Inc.
Fremont, Ohio 43420

Omar Rendering Company
Chula Vista, California

Pacific Disposal Systems
Martinez, California

Pollution Control
El Dorado, Arkansas 71730

Richmond Sanitary Service
Richmond, California

Rollins Environmental Services, Inc.
Wilmington, Delaware
Swedesboro, New Jersey
Baton Rouge, Louisiana
Houston, Texas
Deer Park, Texas

Robert Ross & Sons, Inc.
Grafton, Ohio 44044

Rozema Industrial Waste
Hudsonville, Michigan

SCA Services, Inc.
Boston, Massachusetts
Bay City, Michigan
Model City, New York (Chem-Trol Plant)

Spartan Chemical Company
Wyoming, Michigan 49509

C. Stoddard & Sons Company
Wayland, Michigan 49348

D. A. Stuart Oil Co., Ltd.
Northville, Michigan
Chicago, Illinois

Systech Waste Treatment Co.
Muskegon Heights, Michigan 49444

Thomas Solvent Co., Inc.
Battle Creek, Michigan 49016

Thrall Oil & Chemical Co., Inc.
Flint, Michigan 48503

U. S. Chemical Co., Inc.
Roseville, Michigan 48066

U. S. Pollution Control, Inc.
Division, Beard Oil Co.
Oklahoma City, Oklahoma

U. S. Scrap Company
Chicago, Illinois

Usher Oil Service, Inc.
Detroit, Michigan

Wagoner Transportation Company
Muskegon Heights, Michigan

Waste Acid Services
Detroit, Michigan

APPENDIX B-7 (Cont'd.)

Waste Management, Inc.
Chicago, Illinois

Owen G. Weisenbach
Sebewaing, Michigan 48759

Zero Waste Systems, Inc.
Oakland, California 94608

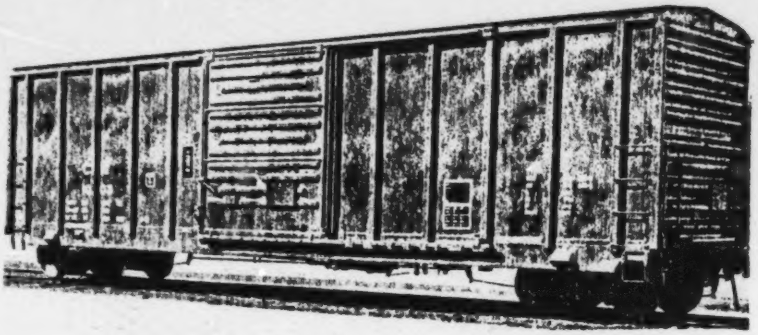
APPENDIX C

ILLUSTRATIONS OF TRANSPORT VEHICLES

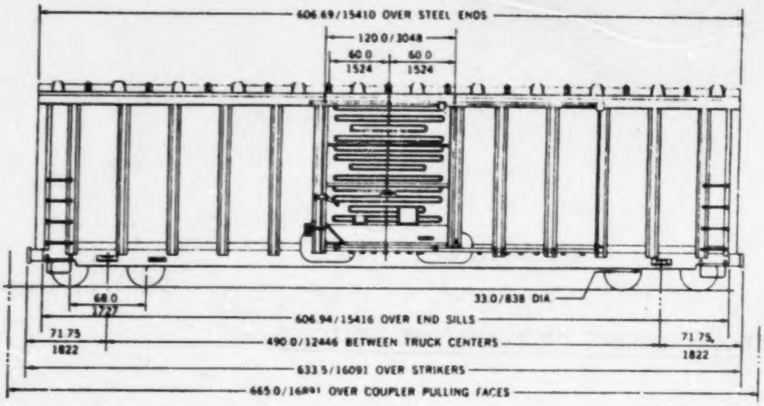
FREIGHT CARS: Box, Class XM

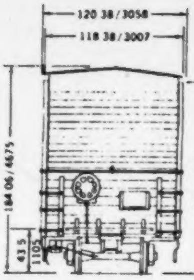
CHICAGO AND ILLINOIS MIDLAND BOXCAR

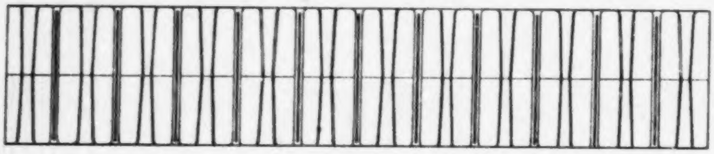
Rated capacity is 154,000 lbs. or 5227 cu. ft. Dimensional data is shown on the general arrangement diagram, below. Built 1973.



PULLMAN-STANDARD 50-FOOT GENERAL PURPOSE BOXCAR

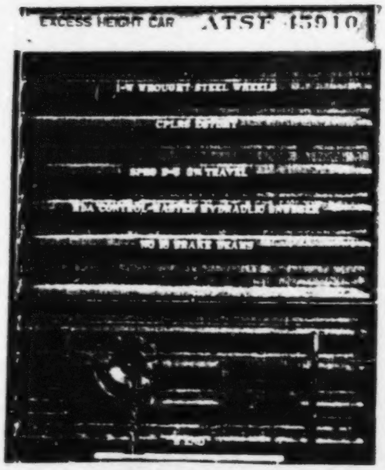

606.69/15410 OVER STEEL ENDS
120.0/3048
60.0
1524
60.0
1524
68.0
1727
33.0/838 DIA
606.94/15416 OVER END SILLS
71.75
1822
490.0/12446 BETWEEN TRUCK CENTERS
71.75
1822
633.5/16091 OVER STRIKERS
665.0/16891 OVER COUPLER PULLING FACES

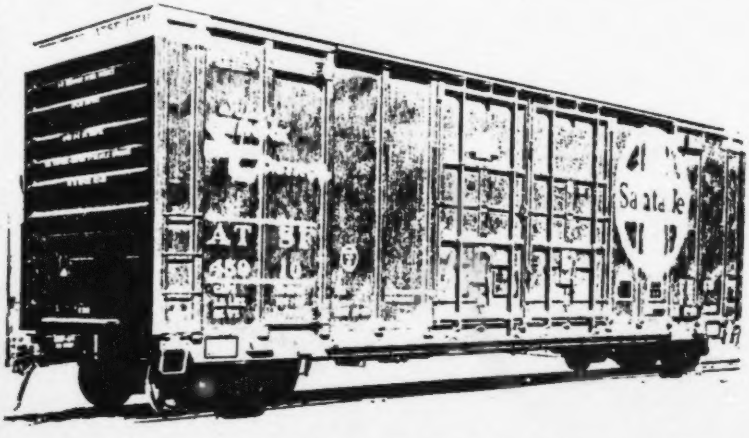

120.38/3058
118.38/3007
184.06/4675
175.5/4458
43.5
1105



$\frac{\text{INCH}}{\text{MILLIMETER}}$: INCH/MILLIMETER

Dimensions are given first in English, then in metric form, following accepted standards for dimensioning drawings. English dimensions are in inches with decimal fractions, metric in millimeters.


EXCESS HEIGHT CAR
ATSF 45910
1-W WROUGHT STEEL WHEELS
CPLRS OFFSET
SPRD D-6 ON TRAVEL
NO 18 BRAKE BEAMS


AT SF
Santa Fe

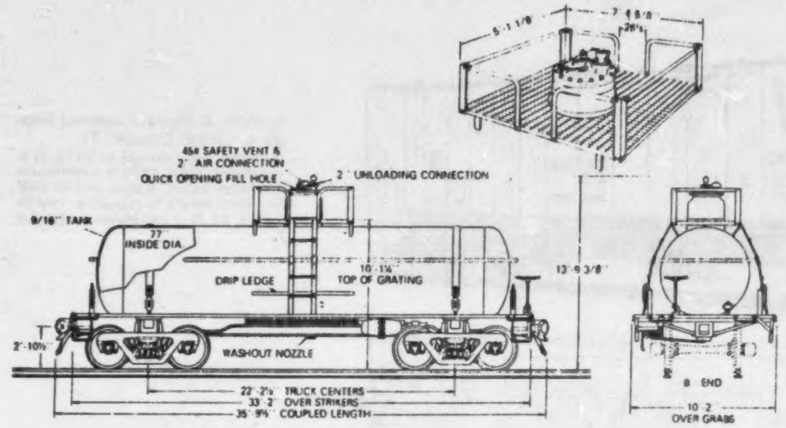
ATCHISON, TOPEKA AND SANTA FE HI-CUBE BOXCAR

An excess height hi-cube car, it has a rated capacity of 185,000 lbs. or 6196 cu. ft. Outside dimensions are 58 ft. 11 in. high, 10 ft. 8 in. wide and 16 ft. 11 in. high. Inside dimensions are 50 ft. 6 in. long, 9 ft. 6 in. wide and 12 ft. 11 in. high. Total door opening measures 16 ft. wide and 12 ft. high. Built by Pullman-Standard, 1974.

Source: Car and Locomotive Cyclopedia, Centennial Edition, Simmons-Boardman, New York, 1974.

B-End Arrangement

FREIGHT CARS: Tank


5'-1 1/8"
7'-8 5/8"
28⅛
45# SAFETY VENT & 2" AIR CONNECTION
QUICK OPENING FILL HOLE
2" UNLOADING CONNECTION
9/16" TANK
77" INSIDE DIA
DRIP LEDGE
10'-1¼" TOP OF GRATING
13'-9 3/8"
2'-10½"
WASHOUT NOZZLE
22'-2½" TRUCK CENTERS
33'-2" OVER STRIKERS
35'-9¾" COUPLED LENGTH
B - END
10'-2 OVER GRABS

7,000 GALLON CAPACITY - NON INSULATED
DOT - 103AW
FOR SULFURIC ACID SERVICE

MINIMUM HORIZONTAL CURVE NEGOTIABILITY

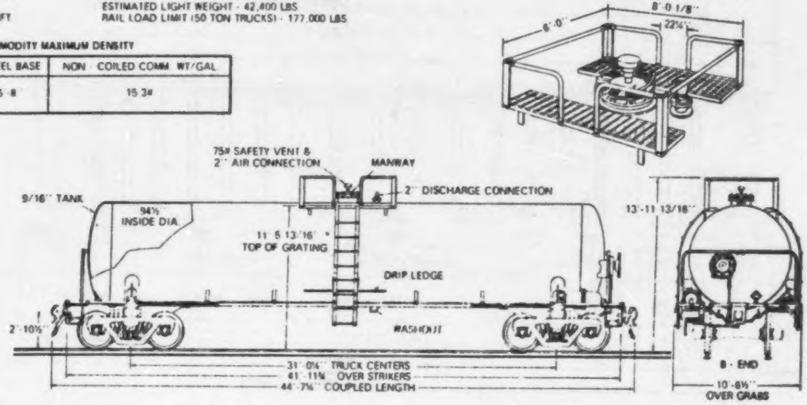
1. TWO LIKE CARS COUPLED TOGETHER - 115 FT
2. TANK CAR ON TANGENT - STANDARD CAR (40'-8") ON CURVE - 152 FT

CAPACITY & WEIGHTS

NOMINAL CAPACITY @ 1% OUTAGE - 7,000 GALS
ESTIMATED LIGHT WEIGHT - 42,400 LBS
RAIL LOAD LIMIT (50 TON TRUCKS) - 177,000 LBS

COMMODITY MAXIMUM DENSITY

TRUCK CAPY	WHEEL BASE	NON - COILED COMM WT/GAL
50 TON	5'-8"	15.3#


6'-0"
8'-0 1/8"
22¼"
75# SAFETY VENT & 2" AIR CONNECTION
MANWAY
2" DISCHARGE CONNECTION
9/16" TANK
94½" INSIDE DIA
11'-5 13/16" TOP OF GRATING
DRIP LEDGE
13'-11 13/16"
2'-10½"
WASHOUT
31'-0¼" TRUCK CENTERS
41'-11¼" OVER STRIKERS
44'-7¼" COUPLED LENGTH
B - END
10'-6½" OVER GRABS

13,350 GALLON CAPACITY - NON INSULATED
DOT - 111A100W2
FOR SULFURIC ACID SERVICE

MINIMUM HORIZONTAL CURVE NEGOTIABILITY

1. TWO LIKE CARS COUPLED TOGETHER - 149 FT.
2. TANK CAR ON CURVE - STANDARD CAR (40'-8") ON TANGENT 117 FT.

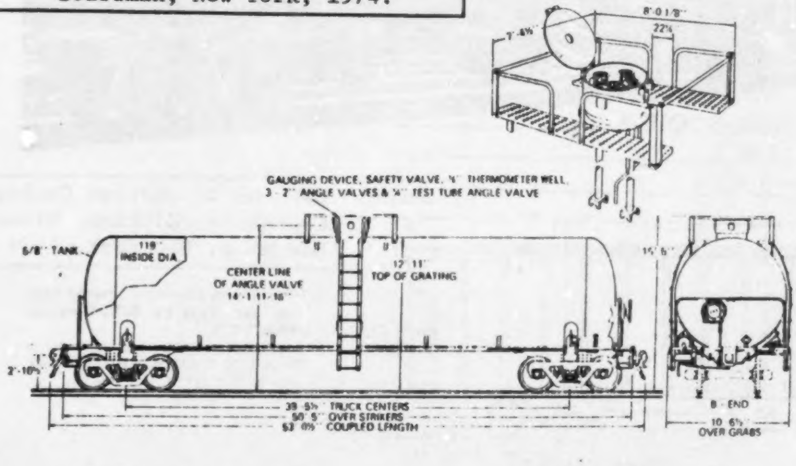
CAPACITY & WEIGHTS

NOMINAL CAPACITY @ 1% OUTAGE - 13,350 GALS.
ESTIMATED LT. WT. (NON COILED) - 55,600 LBS.
RAIL LOAD LIMIT (100 TON TRUCKS) - 263,000 LBS.

COMMODITY MAXIMUM DENSITY

TRUCK CAPY	WHEEL BASE	NON - COILED COMM WT./GAL
100 TON	5'-10"	15.3#

Source: Car and Locomotive Cyclopedia, Centennial Edition, Simmons-Boardman, New York, 1974.


7'-4½"
8'-0 1/8"
22½
GAUGING DEVICE, SAFETY VALVE, ¾" THERMOMETER WELL,
3 - 2" ANGLE VALVES & ¾" TEST TUBE ANGLE VALVE
5/8" TANK
119" INSIDE DIA
CENTER LINE OF ANGLE VALVE 14'-1 11/16"
12' 11" TOP OF GRATING
15' 5"
2'-10½"
39'-5½" TRUCK CENTERS
50'-5" OVER STRIKERS
53'-0½" COUPLED LENGTH
B - END
10' 6½" OVER GRABS

26,100 GALLON CAPACITY - NON INSULATED
DOT - 112A340W
FOR VINYL CHLORIDE SERVICE

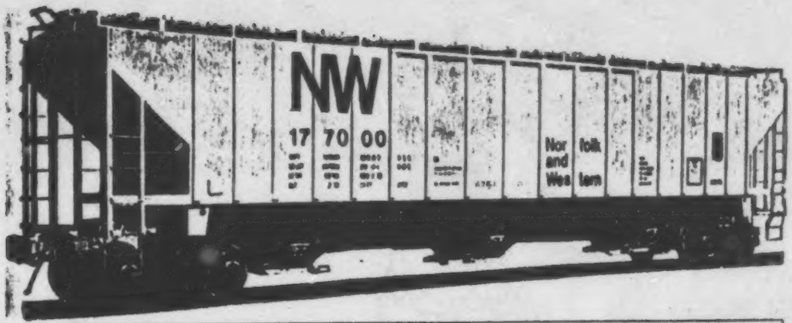
MINIMUM HORIZONTAL CURVE NEGOTIABILITY

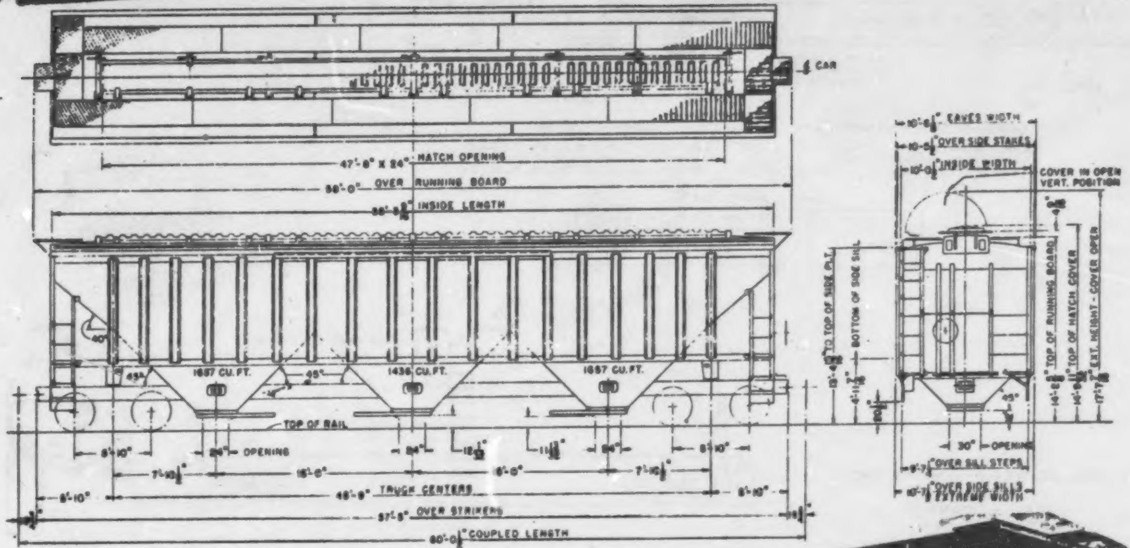
1. TWO LIKE CARS COUPLED TOGETHER - 180 FT
2. TANK CAR ON CURVE - STANDARD CAR (40'-8") ON TANGENT 150 FT

CAPACITY & WEIGHTS

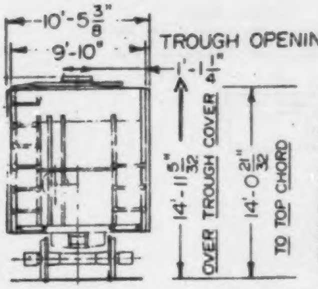
NOMINAL CAPACITY @ 86% FILLING DENSITY - 26,100 GALS
ESTIMATED LIGHT WEIGHT - 74,500 LBS
RAIL LOAD LIMIT (100 TON TRUCKS) - (5'-10" WHEEL BASE) - 263,000 LBS

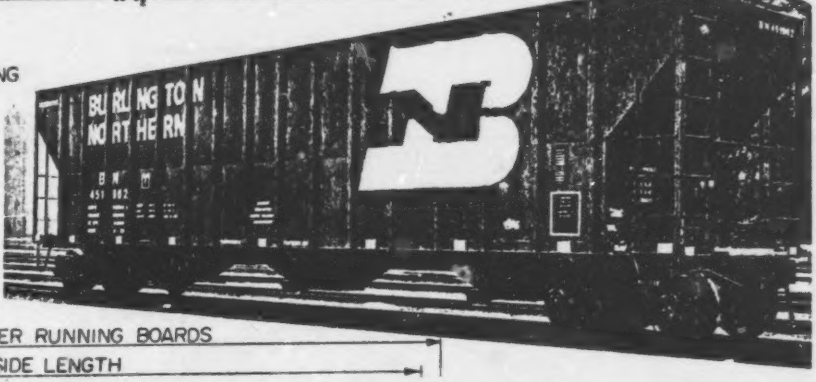
FREIGHT CARS: Covered Hoppers, Class LO

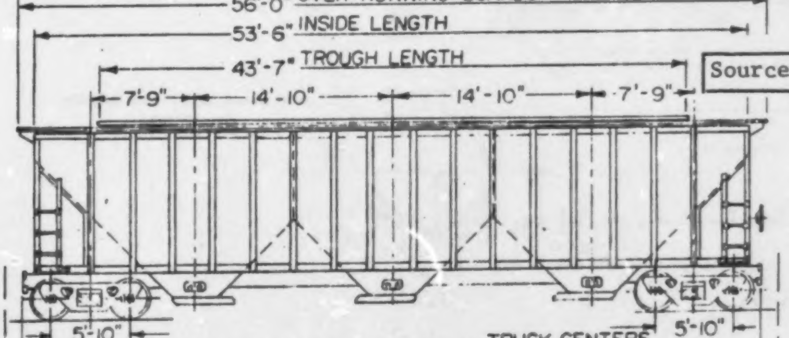

NW
17 70 00
Norfolk and Western


℄ CAR
47'-6" X 24" HATCH OPENING
56'-0" OVER RUNNING BOARD
INSIDE LENGTH
1657 CU. FT.
1436 CU. FT.
1657 CU. FT.
45°
40°
TOP OF RAIL
5'-10"
24" OPENING
24"
7'-10$\frac{1}{2}$"
15'-0"
15'-0"
TRUCK CENTERS
OVER STRIKERS
COUPLED LENGTH
TO TOP OF SIDE PLT.
BOTTOM OF SIDE SILL
EAVES WIDTH
OVER SIDE STAKES
INSIDE WIDTH
COVER IN OPEN VERT. POSITION
TOP OF RUNNING BOARD
TOP OF HATCH COVER
EXT. HEIGHT - COVER OPEN
30" OPENING
OVER SILL STEPS
OVER SIDE SILLS & EXTREME WIDTH

Norfolk & Western covered hopper car, Road Class HC-71.
Built by the railroad in 1973, it is equipped with gravity-pneumatic discharge gates. Rated at 196,000 lbs or 4750 cu ft capacity. Inside length 55 ft 3 in.; inside width 10 ft.


10'-5$\frac{3}{8}$"
9'-10"
TROUGH OPENING
1'-1$\frac{1}{4}$"
14'-11$\frac{5}{32}$" OVER TROUGH COVER
14'-0$\frac{21}{32}$" TO TOP CHORD

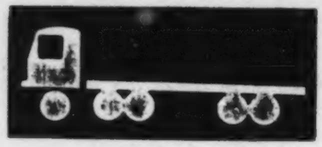

BURLINGTON NORTHERN
BN


56'-0" OVER RUNNING BOARDS
53'-6" INSIDE LENGTH
43'-7" TROUGH LENGTH
7'-9"
14'-10"
14'-10"
7'-9"
5'-10"
5'-10"
45'-2" TRUCK CENTERS
55'-1" OVER STRIKERS
57'-8$\frac{1}{2}$" OVER COUPLER PULLING FACES

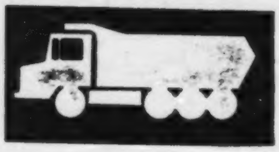
Source: Car and Locomotive Cyclopedia, Centennial Edition, Simmons-Boardman, New York, 1974.

Burlington Northern covered hopper car. Built by FMC Corporation, 1973.
Inside length 53 ft 6 in. Outside length 57 ft 8½ in. Rated capacity is 197,000 lbs or 4700 cu ft.

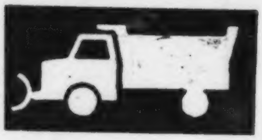
TRUCKS



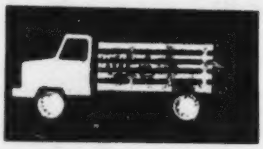
Flatbed
7 MPG
65,000 lb. Capacity



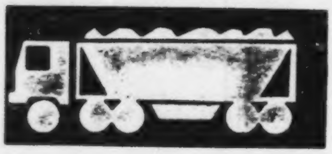
Large Dump
6 MPG
55,000 lb. Capacity



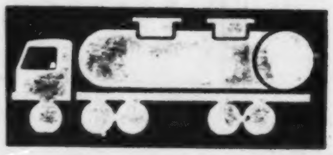
Small Dump
7 MPG
20,000 lb. Capacity



Stake
8 MPG
15,000 lb. Capacity



Hopper-Type Dump
6 MPG
80,000 lb. Capacity

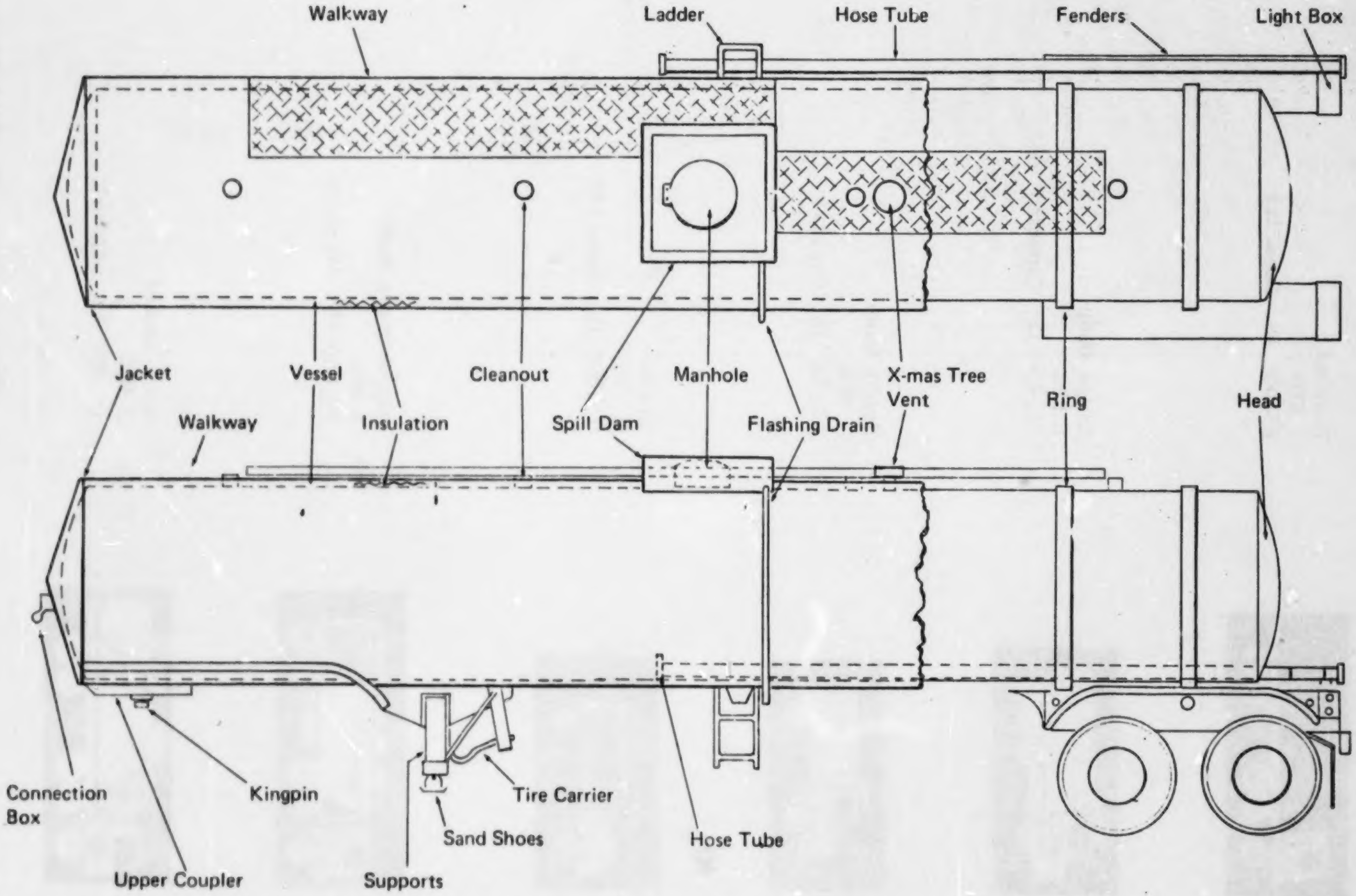


Bulk Tanker
7 MPG
65,000 lb. Capacity

Source: Motor Vehicle Manufacturers Association, Detroit, Michigan.

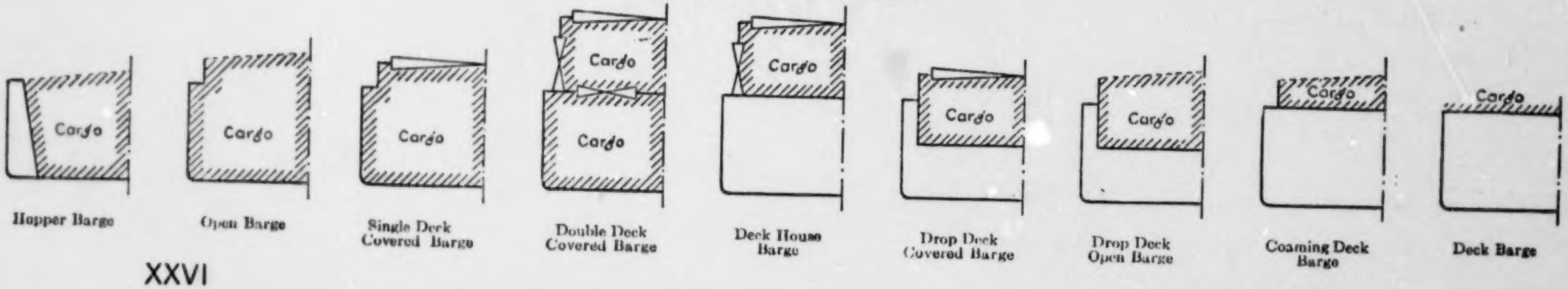
TANK NOMENCLATURE

MC 307 CHEMICAL


Walkway
Ladder
Hose Tube
Fenders
Light Box
Jacket
Vessel
Cleanout
Manhole
X-mas Tree Vent
Ring
Head
Walkway
Insulation
Spill Dam
Flashing Drain
Connection Box
Kingpin
Tire Carrier
Sand Shoes
Hose Tube
Upper Coupler
Supports

Source: Transportation Equipment Corp., Minneapolis, Minnesota

TYPES OF BARGES ON INLAND WATERS
AS DESIGNATED IN COL. 3


Cargo
Hopper Barge
Cargo
Open Barge
Cargo
Single Deck Covered Barge
Cargo
Cargo
Double Deck Covered Barge
Cargo
Deck House Barge
Cargo
Drop Deck Covered Barge
Cargo
Drop Deck Open Barge
Cargo
Coaming Deck Barge
Cargo
Deck Barge

XXVI

Source: Record of American Bureau of Shipping, New York, 1965.

APPENDIX D

SAMPLE SHIPPING DOCUMENTS

1. Rail Carrier

(For Use in Connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941) S-1553

UNIFORM STRAIGHT BILL OF LADING AND TRANSIT RECORD

NO. 1 **THIS SHIPPING ORDER** must be legibly filled in, in Ink, in Indelible pencil, or in carbon and retained by the Agent.

Shipper's No.__________

Southern Pacific Transportation Company

Agent's No.__________

RECEIVED, subject to the classifications and tariffs in effect on the date of the receipt by the carrier of the property described in the Original Bill of Lading,

At RICHMOND, CALIFORNIA July 1 19 77

From ABC REFINING COMPANY

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract), agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to: ABC DISTRIBUTOR COMPANY

Destination LOS ANGELES State CALIFORNIA County__________

(shipping name or description)

Route SP

(classification)

Delivering Carrier SP Car Initials GATX Car No. 12345

SERVICE DESIRED: Door to Door ( ) • Door to Depot ( ) • Depot to Door ( ) • Depot to Depot ( )

No. Pkgs.	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*Weight (Subj. to Corr.)	Class or Rate	Check Col.
1	T/C GASOLINE ①	150,000	④	
③	FLAMMABLE LIQUID ②			
	PLACARDED FLAMMABLE ⑤	(Total quantity)		
	(placard notation)			
	(basic description)			
	(certification)			
	⑥ This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation			
	John Smith Agent ABC REFINING Co.			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

____
(Signature of consignor)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Rec'd $__________
to apply in prepayment of the charges on the property described hereon.

____
Agent or Cashier

Per__________
(The signature here acknowledges only the amount prepaid.)

Charges Advanced $__________

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding__________ per__________

COLLECT ON DELIVERY $__________ **COD Charge to be Paid By: Consignee ( ) Shipper ( )**

INBOUND REFERENCE

Tender is hereby made of the following recorded Freight Bills or Transit Tonnage Credit Slips, to be applied on the above outbound shipment:

Transit Bureau No.	Commodity	Transit Operation	FROM	Car No.	Way-Bill Date	Way-Bill No.	Issuing Road	Rate	Transit Weight	Transit Weight Used	Balance Due Transit House	Balance of Rate

ABC REFINING COMPANY Shipper

Per__________

2

☞ Agent must detach and retain this Shipping Order and must sign the Original Bill of Lading.

Permanent postoffice address of shipper__________

(This Bill of Lading is to be signed by the shipper and agent of the carrier issuing same.)

(For Use in Connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941)

UNIFORM STRAIGHT BILL OF LADING AND TRANSIT RECORD

No. 2

THIS MEMORANDUM is an acknowledgment that a bill of lading has been issued and is not the Original Bill of Lading nor a copy or duplicate covering the property named herein, and is intended solely for filing or record.

Shipper's No.________

Southern Pacific Transportation Company

Agent's No.________

RECEIVED, subject to the classifications and tariffs in effect on the date of the receipt by the carrier of the property described in the Original Bill of Lading.

At Richmond, California July 1, 19 77

From ABC Manufacturing Company

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract), agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to: ABC Distributor Company 107 Main, Los Angeles, Calif.

Destination Los Angeles State California County________

Route SP

Delivering Carrier SP Car Initials SP Car No. 12345

SERVICE DESIRED: Door to Door ( ) • Door to Depot ( ) • Depot to Door ( ) • Depot to Depot ( )

No. Pkgs.	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*Weight (Subj. to Corr.)	Class or Rate	Check Col.
100	Arsenic, Solid ① } ③	2,000 ④		
	Poison B ② }			
	Placarded Poison ⑤			
300	Detergent, intermediate, petro alkylate	600		
50	Bowling Balls, plastic	500		

⑥ This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

John Smith, Agent, ABC MFG. CO.

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of con[illegible])

If charges are to be p[illegible], write or stamp here, "To be Prepaid."

Rec'd $________
to apply in prepayment of [illegible]rges on the property described hereo[illegible]

Agent or Cashier

Per________
(The signature here ac[illegible] [illegible]ges only the amount [illegible])

Charges Advanced $________

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding________ per________

COLLECT ON DELIVERY $________ COD Charge to be Paid By: Consignee ( ) Shipper ( )

INBOUND [illegible]

Tender is hereby made of the following recorded Freight Bills or Transit Tonnage Credit Slips, to be applied on the above outbound shipment:

Transit Bureau No.	Commodity	Transit Operation	FROM	Car No.	Way-Bill Date	Way-Bill No.	Issuing Road	Rate	Transit Weight	Transit Weight Used	Balance Due Transit House	[illegible]nce [illegible]ate

① Shipping name or description (172.202 (1))
② Classification (172.202 (2))
③ Basic description (172.202 (4b))
④ Total quantity (172.202 (4c))
⑤ Placard notation (172.203 (g))
⑥ Certification (172.204 (a))

ABC Manufacturing co. Shipper ________ Agent

Per________ 3 Per________

Permanent postoffice address of shipper________

(This Bill of Lading is to be signed by the shipper and agent of the carrier issuing same.)

D-4

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941)

UNIFORM STRAIGHT BILL OF LADING AND TRANSIT RECORD

ORIGINAL – NOT NEGOTIABLE

No. 3

Shipper's No.

Southern Pacific Transportation Company

Agent's No.

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

At Richmond, California July 1, 1977

From ABC Manufacturing Company

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract), agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to: ABC Distributor Company 107 Main, Los Angeles, Calif.

Destination Los Angeles State California County

Route SP

Delivering Carrier SP Car Initials SP Car No. 12345

SERVICE DESIRED: Door to Door ( ) • Door to Depot ( ) • Depot to Door ( ) • Depot to Depot ( )

No. Pkgs.	HM	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*Weight (Sub. to Corr.)	Class or Rate	Check Col.
300		Detergent, intermediate, petro alkylate	600		
100	X	Arsenic, Solid ①}③	2,000 ④		
		Poison B ②			
		Placarded Poison ⑤			
500		Bowling Balls, plastic	500		

⑥

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

John Smith, Agent, ABC MFG. CO.

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of consignor)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Rec'd $

to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced $

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding per

COLLECT ON DELIVERY $ **COD Charge to be Paid By: Consignee ( ) Shipper ( )**

INBOUND REFERENCE

Tender is hereby made of the following recorded Freight Bills or Transit Tonnage Credit Slips, to be applied on the above outbound shipment:

Transit Bureau No.	Commodity	Transit Operation	FROM	Car No.	Way-Bill Date	Way-Bill No.	Issuing Road	Rate	Transit Weight	Transit Weight Used	Balance Due Transit House	Balance of Rate
			① Shipping name or description (172.202 (1)) ② Classification (172.202 (2)) ③ Basic description (172.202 (4b)) ④ Total quantity (172.202 (4c)) ⑤ Placard notation (172.203 (g)) ⑥ Certification (172.204 (a))									

ABC Manufacturing Co. Shipper

Agent

Per

1

Per

Permanent postoffice address of shipper

(This bill of lading is to be signed by the shipper and agent of the carrier issuing same.)

D-5

(For Use in Connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941)

UNIFORM STRAIGHT BILL OF LADING AND TRANSIT RECORD

No. 4

THIS SHIPPING ORDER must be legibly filled in, in ink, in indelible pencil, or in carbon and retained by the Agent.

Shipper's No.________

Southern Pacific Transportation Company

Agent's No.________

RECEIVED, subject to the classifications and tariffs in effect on the date of the receipt by the carrier of the property described in the Original Bill of Lading.

At Richmond, California July 1, 19 77

From ABC Manufacturing Company

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract), agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to: ABC Distributor Company 107 Main, Los Angeles, Calif.

Destination Los Angeles State California County________

Route SP

Delivering Carrier Sp Car Initials SP Car No. 12345

SERVICE DESIRED: Door to Door ( ) • Door to Depot ( ) • Depot to Door ( ) • Depot to Depot ( )

No. Pkgs.	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*Weight (Subj. to Corr.)	Class or Rate	Check Col.
50	Bowling Balls, plastic	500		
300	Detergent, intermediate, petro alkylate	600		
100	Arsenic, Solid ① } ③	2,000 ④		
	Poison B ②			
	Placarded Poison ⑤			
	⑥			
	This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.			
	John Smith, Agent, ABC MFG. CO.			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

____
(Signature of consignor)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Rec'd $________
to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per________
(The signature here acknowledges only the amount prepaid.)

Charges Advanced $________

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding ______ per ______

COLLECT ON DELIVERY $________ **COD Charge to be Paid By: Consignee ( ) Shipper ( )**

INBOUND REFERENCE

Tender is hereby made of the following recorded Freight Bills or Transit Tonnage Credit Slips, to be applied on the above outbound shipment:

Transit Bureau No.	Commodity	Transit Operation	FROM	Car No.	Way-Bill Date	Way-Bill No.	Issuing Road	Rate	Transit Weight	Transit Weight Used	Balance Due Transit House	Balance of Rate
			① Shipping name or description (172.202 (1))									
			② Classification (172.202 (2))									
			③ Basic description (172.202 (4b))									
			④ Total quantity (172.202 (4c))									
			⑤ Placard notation (172.203 (viii g))									
			⑥ Certification (172.204 (a))									

ABC Manufacturing Co. Shipper

Per________

Agent must detach and retain this Shipping Order and must sign the Original Bill of Lading.

Permanent postoffice address of shipper________
(This Bill of Lading is to be signed by the shipper and agent of the carrier issuing same.)

D-6

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(For Use in Connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941.) S-1553

UNIFORM STRAIGHT BILL OF LADING AND TRANSIT RECORD

No.5

THIS SHIPPING ORDER must be legibly filled in, in ink, in indelible pencil, or in carbon and retained by the Agent.

Shipper's No.______

Southern Pacific Transportation Company

Agent's No.______

RECEIVED, subject to the classifications and tariffs in effect on the date of the receipt by the carrier of the property described in the Original Bill of Lading,

At Richmond, California July 1, 1977

From ABC Refining Company

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to: ABC Distributor Company 107 Main, Los Angeles, Calif.

Destination Los Angeles State California County______

Route SP

Delivering Carrier SP Car Initials GATX Car No. 12345

SERVICE DESIRED: Door to Door ( ) • Door to Depot ( ) • Depot to Door ( ) • Depot to Depot ( )

No. Pkgs.	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*Weight (Subj. to Corr.)	Class or Rate	Check Col.
1	Tank Car			
	EMPTY: Last Contained Gasoline			
	Flammable liquid, Placarded			
	OR			
1	Tank Car			
	Empty, Gasoline,			
	Flammable liquid, Placarded			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of consignor)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Rec'd $______ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per______ (The signature here acknowledges only the amount prepaid.)

Charges Advanced $______

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding______ per______

COLLECT ON DELIVERY $______ COD Charge to be Paid By: Consignee ( ) Shipper ( )

INBOUND REFERENCE

Tender is hereby made of the following recorded Freight Bills or Transit Tonnage Credit Slips, to be applied on the above outbound shipment.

Transit Bureau No.	Commodity	Transit Operation	FROM	Car No.	Way-Bill Date	Way-Bill No.	Issuing Road	Rate	Transit Weight	Transit Weight Used	Balance Due Transit House	Balance of Rate

ABC Refinkng Company Shipper

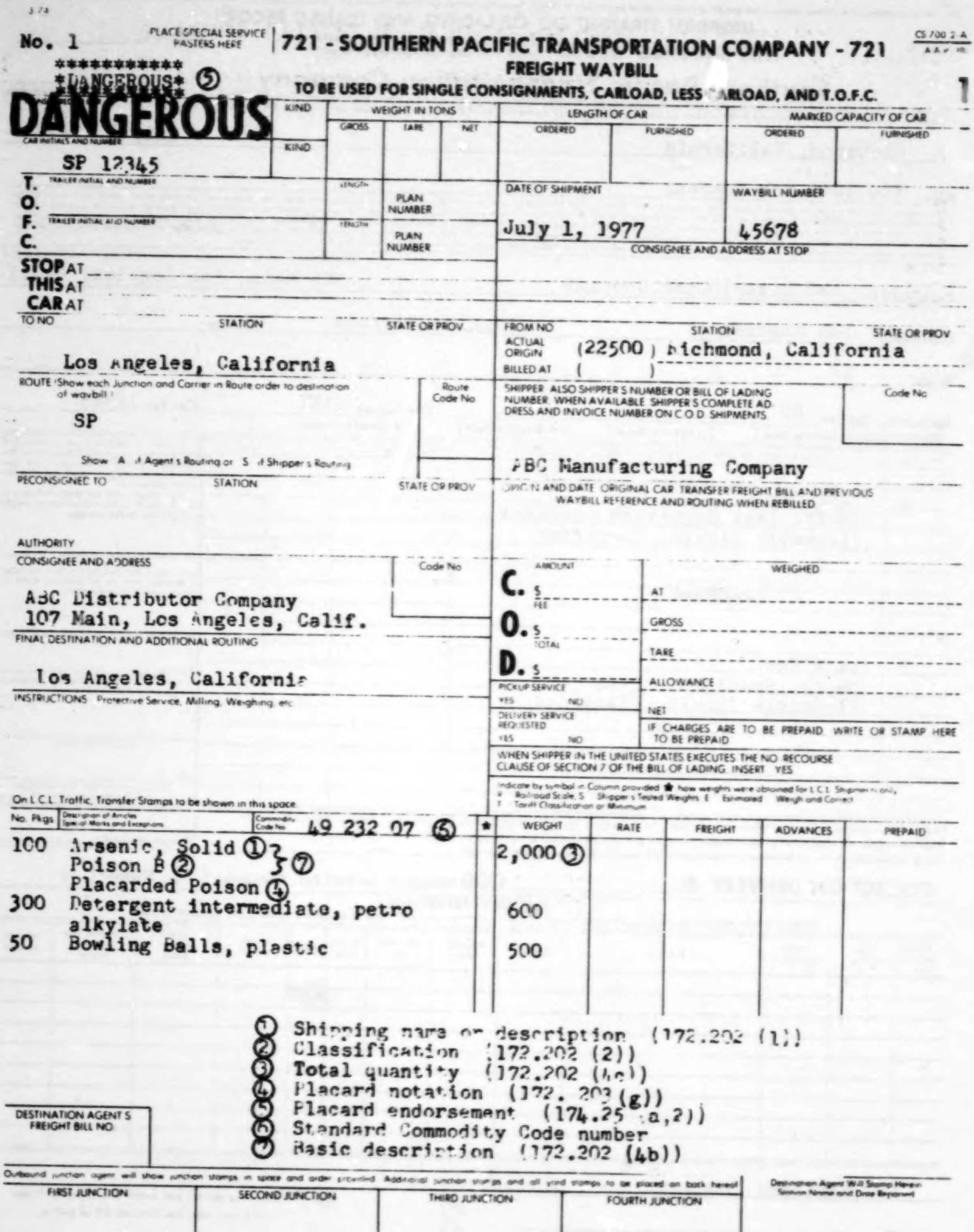
Per______

2

☞ Agent must detach and retain this Shipping Order and must sign the Original Bill of Lading.

Permanent postoffice address of shipper______ D-7 ______ 61

(This Bill of Lading is to be signed by the shipper and agent of the carrier issuing same.)



3-74

No. 1

PLACE SPECIAL SERVICE PASTERS HERE

721 - SOUTHERN PACIFIC TRANSPORTATION COMPANY - 721

CS 700 2-A

FREIGHT WAYBILL

TO BE USED FOR SINGLE CONSIGNMENTS, CARLOAD, LESS CARLOAD, AND T.O.F.C.

1

****
DANGEROUS ⑤
****

DANGEROUS

CAR INITIALS AND NUMBER: SP 12345

KIND	WEIGHT IN TONS			LENGTH OF CAR		MARKED CAPACITY OF CAR	
	GROSS	TARE	NET	ORDERED	FURNISHED	ORDERED	FURNISHED
KIND							

T.O.F.C.
TRAILER INITIAL AND NUMBER — LENGTH — PLAN NUMBER
TRAILER INITIAL AND NUMBER — LENGTH — PLAN NUMBER

DATE OF SHIPMENT: July 1, 1977
WAYBILL NUMBER: 45678

STOP THIS CAR AT
STOP THIS CAR AT
STOP THIS CAR AT

CONSIGNEE AND ADDRESS AT STOP

TO NO — STATION — STATE OR PROV
Los Angeles, California

FROM NO — STATION — STATE OR PROV
ACTUAL ORIGIN (22500) Richmond, California
BILLED AT ( )

ROUTE (Show each Junction and Carrier in Route order to destination of waybill)
SP

Route Code No

Show A if Agent's Routing or S if Shipper's Routing

SHIPPER ALSO SHIPPER'S NUMBER OR BILL OF LADING NUMBER WHEN AVAILABLE SHIPPER'S COMPLETE ADDRESS AND INVOICE NUMBER ON C.O.D. SHIPMENTS
ABC Manufacturing Company

Code No

RECONSIGNED TO — STATION — STATE OR PROV

ORIGIN AND DATE ORIGINAL CAR TRANSFER FREIGHT BILL AND PREVIOUS WAYBILL REFERENCE AND ROUTING WHEN REBILLED

AUTHORITY

CONSIGNEE AND ADDRESS
ABC Distributor Company
107 Main, Los Angeles, Calif.

Code No

FINAL DESTINATION AND ADDITIONAL ROUTING
Los Angeles, California

INSTRUCTIONS Protective Service, Milling, Weighing, etc.

C.O.D.
AMOUNT $
FEE $
TOTAL $

PICKUP SERVICE YES NO
DELIVERY SERVICE REQUESTED YES NO

WEIGHED
AT
GROSS
TARE
ALLOWANCE
NET

IF CHARGES ARE TO BE PREPAID WRITE OR STAMP HERE TO BE PREPAID

WHEN SHIPPER IN THE UNITED STATES EXECUTES THE NO RECOURSE CLAUSE OF SECTION 7 OF THE BILL OF LADING INSERT YES

Indicate by symbol in Column provided ★ how weights were obtained for L.C.L. Shipments only
R Railroad Scale, S Shipper's Tested Weights, E Estimated, Weigh and Correct
T Tariff Classification or Minimum

On L.C.L. Traffic, Transfer Stamps to be shown in this space

No. Pkgs	Description of Articles Special Marks and Exceptions	Commodity Code No 49 232 07 ⑥	★	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
100	Arsenic, Solid ① Poison B ② } ⑦ Placarded Poison ④			2,000 ③				
300	Detergent intermediate, petro alkylate			600				
50	Bowling Balls, plastic			500				

① Shipping name or description (172.202 (1))
② Classification (172.202 (2))
③ Total quantity (172.202 (4c))
④ Placard notation (172. 203 (g))
⑤ Placard endorsement (174.25 (a,2))
⑥ Standard Commodity Code number
⑦ Basic description (172.202 (4b))

DESTINATION AGENT'S FREIGHT BILL NO.

Outbound junction agent will show junction stamps in space and order provided. Additional junction stamps and all yard stamps to be placed on back hereof

FIRST JUNCTION	SECOND JUNCTION	THIRD JUNCTION	FOURTH JUNCTION

Destination Agent Will Stamp Herein Station Name and Date Received

721 - SOUTHERN PACIFIC TRANSPORTATION COMPANY - 721

3-74

PLACE SPECIAL SERVICE
PASTERS HERE

****
DANGEROUS
****

721 - SOUTHERN PACIFIC TRANSPORTATION COMPANY - 721

CS 700 2-A
(A.A.R. 98)

FREIGHT WAYBILL

TO BE USED FOR SINGLE CONSIGNMENTS, CARLOAD, LESS CARLOAD, AND T.O.F.C.

1

TRANSFERRED TO CAR

KIND

CAR INITIALS AND NUMBER GATX 12345

KIND

WEIGHT IN TONS			LENGTH OF CAR		MARKED CAPACITY OF CAR	
GROSS	TARE	NET	ORDERED	FURNISHED	ORDERED	FURNISHED

T.O.F.C.
TRAILER INITIAL AND NUMBER
LENGTH
PLAN NUMBER
TRAILER INITIAL AND NUMBER
LENGTH
PLAN NUMBER

DATE OF SHIPMENT July 1, 1977

WAYBILL NUMBER 23456

STOP THIS CAR AT
CONSIGNEE AND ADDRESS AT STOP

TO NO. STATION STATE OR PROV.

FROM NO. STATION STATE OR PROV.
ACTUAL ORIGIN (22500) Richmond, California
BILLED AT ( )

ROUTE (Show each Junction and Carrier in Route order to destination of waybill.)
SP
Show A if Agent's Routing or S if Shipper's Routing

Route Code No

SHIPPER, ALSO SHIPPER'S NUMBER OR BILL OF LADING NUMBER, WHEN AVAILABLE. SHIPPER'S COMPLETE ADDRESS AND INVOICE NUMBER ON C.O.D. SHIPMENTS.
ABC Manufacturing Company

Code No

RECONSIGNED TO STATION STATE OR PROV.

ORIGIN AND DATE, ORIGINAL CAR, TRANSFER FREIGHT BILL AND PREVIOUS WAYBILL REFERENCE AND ROUTING WHEN REBILLED.

AUTHORITY

CONSIGNEE AND ADDRESS
ABC Distributor Company
107 Main Los Angeles, Calif.

Code No.

C.O.D.
AMOUNT $
FEE $
TOTAL $

WEIGHED
AT
GROSS
TARE
ALLOWANCE
NET

FINAL DESTINATION AND ADDITIONAL ROUTING
Los Angeles, California

INSTRUCTIONS - Protective Service, Milling, Weighing, etc.

PICKUP SERVICE
YES NO

DELIVERY SERVICE REQUESTED
YES NO

IF CHARGES ARE TO BE PREPAID, WRITE OR STAMP HERE "TO BE PREPAID."

WHEN SHIPPER IN THE UNITED STATES EXECUTES THE NO-RECOURSE CLAUSE OF SECTION 7 OF THE BILL OF LADING, INSERT "YES"

Indicate by symbol in Column provided ★ how weights were obtained for L.C.L. Shipments only
R - Railroad Scale, S - Shipper's Tested Weights, E - Estimated - Weigh and Correct
T - Tariff Classification or Minimum.

On L.C.L. Traffic, Transfer Stamps to be shown in this space.

No. Pkgs.	Description of Articles, Special Marks and Exceptions	Commodity Code No	★	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
1	Tank Car EMPTY: Last Contained Gasoline Flammable liquid, Placarded							
	OR							
1	Tank Car Empty, Gasoline Flammable liquid, Placarded							

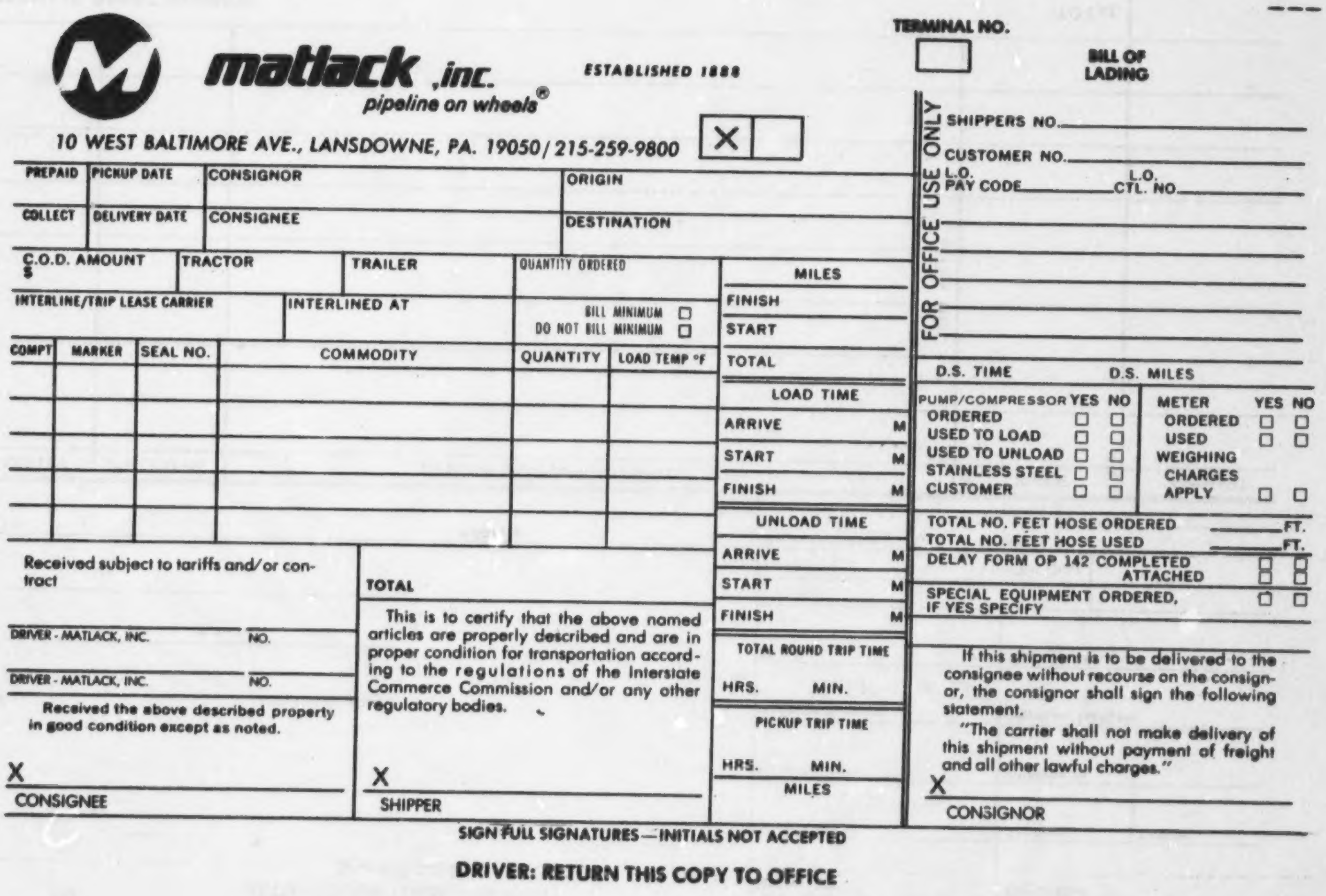
DESTINATION AGENT'S FREIGHT BILL NO.

Outbound junction agent will show junction stamps in space and order provided. Additional junction stamps and all yard stamps to be placed on back hereof

FIRST JUNCTION	SECOND JUNCTION	THIRD JUNCTION	FOURTH JUNCTION	Destination Agent Will Stamp Herein Station Name and Date Reported

721 - SOUTHERN PACIFIC TRANSPORTATION COMPANY - 721

2. Motor Carrier



mattlack ,inc.
pipeline on wheels®
ESTABLISHED 1888
10 WEST BALTIMORE AVE., LANSDOWNE, PA. 19050/215-259-9800

TERMINAL NO. ☐

BILL OF LADING

☒ ☐

PREPAID | PICKUP DATE | CONSIGNOR | ORIGIN
COLLECT | DELIVERY DATE | CONSIGNEE | DESTINATION
C.O.D. AMOUNT $ | TRACTOR | TRAILER | QUANTITY ORDERED
INTERLINE/TRIP LEASE CARRIER | INTERLINED AT
BILL MINIMUM ☐
DO NOT BILL MINIMUM ☐

COMPT	MARKER	SEAL NO.	COMMODITY	QUANTITY	LOAD TEMP °F
			TOTAL		

MILES
FINISH
START
TOTAL

LOAD TIME
ARRIVE M
START M
FINISH M

UNLOAD TIME
ARRIVE M
START M
FINISH M

TOTAL ROUND TRIP TIME
HRS. MIN.

PICKUP TRIP TIME
HRS. MIN.

MILES

Received subject to tariffs and/or contract

DRIVER - MATLACK, INC. NO.

DRIVER - MATLACK, INC. NO.

Received the above described property in good condition except as noted.

X
CONSIGNEE

This is to certify that the above named articles are properly described and are in proper condition for transportation according to the regulations of the Interstate Commerce Commission and/or any other regulatory bodies.

X
SHIPPER

FOR OFFICE USE ONLY

SHIPPERS NO.
CUSTOMER NO.
L.O. PAY CODE
L.O. CTL. NO.

D.S. TIME
D.S. MILES

PUMP/COMPRESSOR	YES	NO	METER	YES	NO
ORDERED	☐	☐	ORDERED	☐	☐
USED TO LOAD	☐	☐	USED	☐	☐
USED TO UNLOAD	☐	☐	WEIGHING CHARGES APPLY	☐	☐
STAINLESS STEEL	☐	☐			
CUSTOMER	☐	☐			

TOTAL NO. FEET HOSE ORDERED ____ FT.
TOTAL NO. FEET HOSE USED ____ FT.
DELAY FORM OP 142 COMPLETED ☐ ☐
ATTACHED ☐ ☐
SPECIAL EQUIPMENT ORDERED, IF YES SPECIFY ☐ ☐

If this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement.

"The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges."

X
CONSIGNOR

SIGN FULL SIGNATURES—INITIALS NOT ACCEPTED

DRIVER: RETURN THIS COPY TO OFFICE

SHIP TO

ROLLINS ENVIRONMENTAL SERVICES, INC.
P. O. BOX 73877
BATON ROUGE, LOUISIANA 70807
504–778-1234

№ *3-25168

Order Date	Ship Date
Ordered By	Dispatcher
Ship Via	Tractor / Trailer
Mileage Out	Mileage In
In Plant Service Yes ☐ No ☐	Number Helpers
Driver	Bill of Lading
Out Res	In Cust.
In Res	Out Cust.
Representative	Zone
	Area

Gross ____________________

Tare ____________________

Net ____________________

Bill To Address

QUANTITY	STREAM No.	DESCRIPTION OF MATERIAL	PRICE	AMOUNT

PURCHASE ORDER NUMBER: TOTAL

SCRAP HAULERS OF RIVERDALE
13840 SO. HALSTED
RIVERDALE, IL 60627
PHONES: (312) 995-1674
(312) 841-7020

№ 01082

Date ____________

Pickup Time ________ AM

Pickup Time ________ PM

CHECK TYPE OF LIQUID WASTE:

		Quantity (Circle one) gallons or barrels
1. Acid Solution	☐	________
2. Alkaline Solution	☐	________
3. Pesticides	☐	________
4. Etching Solution	☐	________
5. Spent Plating Solution	☐	________
6. Catalyst	☐	________
7. Brine	☐	________
8. Emulsion	☐	________
9. Tetra Ethyl Lead Sludge	☐	________
10. Toxic Tank Bottom Sediment	☐	________
11. Other Toxic Solutions: (Name): ________ ________	☐	________
12. Chemical Fertilizer	☐	________
13. Chemical Toilet Wastes	☐	________
14. Cannery Waste	☐	________
15. Oil	☐	________
16. Grease	☐	________
17. Non-toxic Rotary Drilling Mud	☐	________
18. Acetylene Sludge	☐	________
19. Paint Sludge	☐	________
20. Asphalt Sludge	☐	________
21. Latex Waste	☐	________
22. Tile Glaze Waste	☐	________
23. Lime Soda Water	☐	________
24. Solvent	☐	________
25. Non-toxic Mud and Water	☐	________
26. Other Non-toxic Solutions: (Name): ________ ________	☐	________

PRODUCER OF LIQUID WASTE

Name (print or type): ________________________________

Pick up Address ________________________________
(Number) (Street) (City)

Type of process which produced wastes: ________________________________
(Examples: metal plating, equipment cleaning, chemical formulation, etc.)

I certify that the described waste was delivered to the licensed hauler named below for legal disposal at the site indicated

____
Signature of Producer or Authorized Agent and Title

HAULER

Name (print or type) Scrap Haulers of Riverdale

Business Address 13840 So. Halsted Riverdale, Illinois 60627
(Number) (Street) (City)

I certify that the described waste was hauled by me in a vehicle with a valid liquid waste hauler registration certificate to the disposal facility named below and was accepted

State Waste Hauler's Registration No.: ________________

Local Business License Truck Tag No. (if applicable): ________________

________________ ________________
Signature of Hauler or Authorized Agent and Title

DISPOSAL FACILITY

Name (print or type) ________________________________

Site Address ________________________________

I certify that the hauler above delivered the described liquid waste to this disposal facility

Treatment or Recovery Process ______ Pond ______ Spreading Area ______ Landfill Area X ______ Other ______

IF WASTE IS HELD FOR DISPOSAL ELSEWHERE,

SPECIFY FINAL LOCATION ________________

____
Signature of Waste Disposal Facility Operator
Authorized Agent and Title

Producer of Liquid Waste Copy

BL 8.8-6

HAZARDOUS MATERIALS

NAME OF CARRIER

STRAIGHT BILL OF LADING — SHORT FORM — ORIGINAL — Not Negotiable

CARRIER'S NO.

SHIPPER'S NO.

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

the property described below, in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

FROM AT DATE 19

(Mail or street address of consignee—For purposes of notification only.)

CONSIGNED TO

DESTINATION STATE COUNTY

(To be filled in only when shipper desires and governing tariffs provide for delivery thereat.)

DELIVERY ADDRESS

ROUTE DELIVERING CARRIER VEHICLE OR CAR INITIAL & NO.

No. Packages	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*Weight (Sub. to Corr.)	Class or Rate	Ck. Col.
	HAZARDOUS			
	MATERIALS			

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Rec'd $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced $

"Shipper's imprint in lieu of stamp; not a part of bill of lading approved by the Interstate Commerce Commission."

The Fibre Boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Rule 41 of the Consolidated Freight Classification.

C. O. D.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding per

Shipper, Per 1 Agent, Per

Permanent Post Office Address of Shipper

United Parcel Service
637861

SHIPPER'S CERTIFICATION FOR HAZARDOUS MATERIALS

SHIPPER'S NAME AND ADDRESS
~~A. D. LITTLE, INC.~~
CAMBRIDGE, MASS.

MS 464 0-14-213

STAMP YOUR UPS SHIPPER NUMBER ABOVE

	FULL SHIPPING NAME OF ARTICLE (ABBREVIATIONS NOT PERMITTED)	D.O.T. CLASSIFICATION (ABBREVIATIONS NOT PERMITTED)	WT./VOL.	TYPE D.O.T. LABEL REQUIRED (ABBREVIATIONS NOT PERMITTED)	RECEIVER'S NAME (ABBREVIATIONS ARE PERMITTED)	CITY & STATE (ABBREVIATIONS ARE PERMITTED)
1.						
2.						
3.						
4.						
5.						
6.						
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8.						
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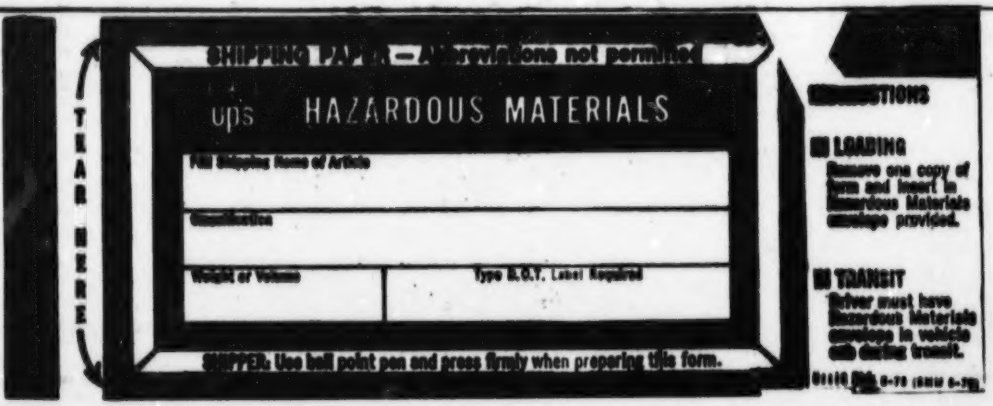
10.						
11.						
12.						
13.						
14.						

CERTIFICATION: This is to certify that the above named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation, Title-49, Part 171-177, Code of Federal Regulations, and Requirements of United Parcel Service:

U1208 Rev. 6-77 (40M BKS-6/77)

Shipper's Signature ______________________ *Date* __/__/__



TEAR HERE

SHIPPING PAPER — Abbreviations not permitted

ups HAZARDOUS MATERIALS

Full Shipping Name of Article

Classification

Weight or Volume

Type D.O.T. Label Required

SHIPPER: Use ball point pen and press firmly when preparing this form.

INSTRUCTIONS

LOADING
Remove one copy of form and insert in Hazardous Materials envelope provided.

TRANSIT
Driver must have Hazardous Materials envelope in vehicle cab during transit.

D-15

3. Barge Carrier

CHOTIN TRANSPORTATION, INC.

LOADING PAPER

Trip No.________________

Order No.________________ Loading Date:________________________

Barge No.________________ Destination — From:________________________

Grade ________________ To:________________________

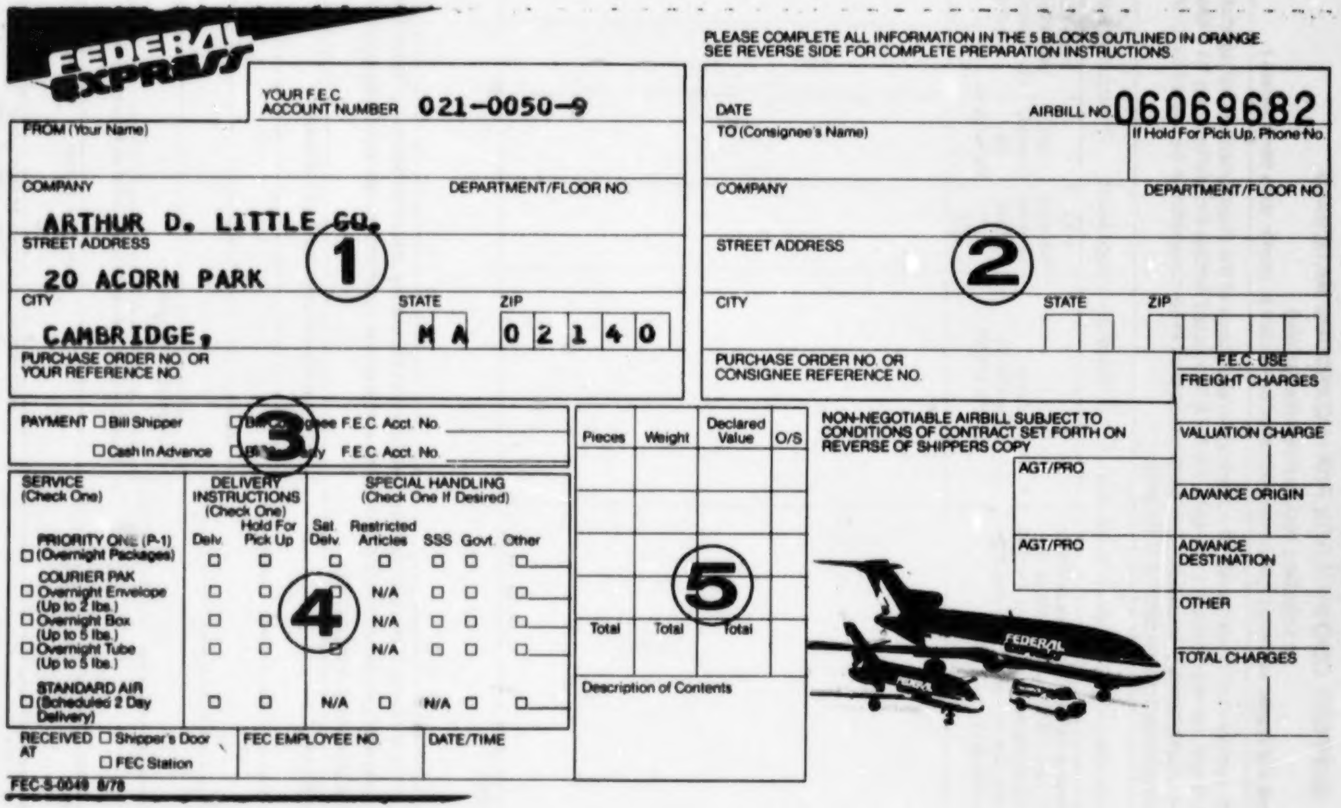
Loading Draft________________

BOW*

No. 1 Port Cargo____________	No. 1 Starboard Cargo____________
No. 2 Port Cargo____________	No. 2 Starboard Cargo____________
No. 3 Port Cargo____________	No. 3 Starboard Cargo____________
No. 4 Port Cargo____________	No. 4 Starboard Cargo____________
No. 5 Port Cargo____________	No. 5 Starboard Cargo____________
No. 6 Port Cargo____________	No. 6 Starboard Cargo____________
STERN	

REMARKS:____

4. Air Carrier



FEDERAL EXPRESS

YOUR F.E.C. ACCOUNT NUMBER 021-0050-9

PLEASE COMPLETE ALL INFORMATION IN THE 5 BLOCKS OUTLINED IN ORANGE
SEE REVERSE SIDE FOR COMPLETE PREPARATION INSTRUCTIONS

①
FROM (Your Name)
COMPANY ARTHUR D. LITTLE CO.
DEPARTMENT/FLOOR NO
STREET ADDRESS 20 ACORN PARK
CITY CAMBRIDGE,
STATE M A
ZIP 0 2 1 4 0
PURCHASE ORDER NO. OR YOUR REFERENCE NO.

②
DATE
AIRBILL NO. 06069682
TO (Consignee's Name)
If Hold For Pick Up, Phone No.
COMPANY
DEPARTMENT/FLOOR NO.
STREET ADDRESS
CITY
STATE
ZIP
PURCHASE ORDER NO. OR CONSIGNEE REFERENCE NO.

③
PAYMENT ☐ Bill Shipper ☐ Bill Consignee F.E.C. Acct. No. ____
☐ Cash In Advance ☐ Bi[illegible]y F.E.C. Acct. No. ____

④

SERVICE (Check One)	DELIVERY INSTRUCTIONS (Check One) Delv.	Hold For Pick Up	SPECIAL HANDLING (Check One If Desired) Sat. Delv.	Restricted Articles	SSS	Govt.	Other
☐ PRIORITY ONE (P-1) (Overnight Packages)	☐	☐	☐	☐	☐	☐	☐ ____
COURIER PAK ☐ Overnight Envelope (Up to 2 lbs.)	☐	☐	☐	N/A	☐	☐	☐ ____
☐ Overnight Box (Up to 5 lbs.)	☐	☐	☐	N/A	☐	☐	☐ ____
☐ Overnight Tube (Up to 5 lbs.)	☐	☐	☐	N/A	☐	☐	☐ ____
☐ STANDARD AIR (Scheduled 2 Day Delivery)	☐	☐	N/A	☐	N/A	☐	☐ ____

RECEIVED AT ☐ Shipper's Door ☐ FEC Station
FEC EMPLOYEE NO
DATE/TIME

⑤

Pieces	Weight	Declared Value	O/S
Total	Total	Total	

Description of Contents

NON-NEGOTIABLE AIRBILL SUBJECT TO CONDITIONS OF CONTRACT SET FORTH ON REVERSE OF SHIPPERS COPY

AGT/PRO

AGT/PRO

F.E.C. USE	
FREIGHT CHARGES	
VALUATION CHARGE	
ADVANCE ORIGIN	
ADVANCE DESTINATION	
OTHER	
TOTAL CHARGES	

PRESS HARD—5 COPIES

ACCOUNTING COPY

FEC-S-0049 8/78

FEDERAL EXPRESS
SHIPPER'S CERTIFICATION FOR HAZARDOUS MATERIALS
(excluding radioactive materials)

Two completed and signed copies of this certification shall be handed to carrier. (Use block letters.)

WARNING: Failure to comply in all respects with the applicable regulations of the Department of Transportation, 49 CFR, Parts 100-199 and, for international shipments, the IATA Restricted Articles Regulations may be a breach of the applicable law, subject to legal penalties. This certification shall in no circumstance be signed by an IATA Cargo Agent or a consolidator for international shipments.

This shipment is within the limitations prescribed for: **(mark one)** ☐ passenger & cargo aircraft ☐ cargo-only aircraft

No. of Pkgs.	Article No. (Int'l only)	Proper Shipping Name of Materials as shown in 49 CFR, part 172.101 and additional description requirements specified in 49 CFR 172.203, and (for int'l shipments) the IATA Restricted Articles Regulations.	Class Specified in 49 CFR 172.101	IATA Packing Note No. Applied (Int'l only)	Net Quantity per Package	Flash Point (closed cup) For Flammable Liquids	
						°C.	°F.

Special Handling Information:

I hereby certify that the contents of this consignment are fully and accurately described above by Proper Shipping Name and are classified, packed, marked, and labelled, and in proper condition for carriage by air according to applicable national government regulations.

Name and full address of Shipper

Name and title of person signing Certification

Emergency telephone no.

Date

Signature of the Shipper (see WARNING above)

Federal Express Airbill No.

Origin Station

Destination Station

FEC-S-0147 REV JAN 78
0041730147

DISTRIBUTION: White Copy – Attached to Airbill
Canary Copy – Attached to Airbill
Pink Copy – Attached to Package
Goldenrod Copy – Shipper

APPENDIX E

RAIL TRANSPORT OF HAZARDOUS WASTE

TABLE E-1

SAMPLE MOVEMENTS OF SPENT SULFURIC ACID ON THE SOUTHERN PACIFIC RAILROAD (1976)

ORIGIN	DESTINATION	AMOUNT IN CARLOADS	TONS/CAR	AMOUNT IN TONS	REVENUE $000	REVENUE $/CWT	MILES
American Oil Salt Lake City, Utah	Stauffer Chemical Martinez, California	120	75	9016	179.3	.99	787
ARCO Channelview, Texas	Texas Farm Products Nacadgoces, Texas	89	46	4100	31.4	.38	135
ARCO Channelview, Texas	Dupont Strang, Texas	224	51	11451	29.3	.13	26
El Paso Acid Ashley, Texas	Stauffer Chemical Houston, Texas	15	85	1269	19.4	.76	823
Olin Chaison, Texas	Stauffer Chemical Houston, Texas	498	66	32851	135.7	.21	65

TABLE E-2

SAMPLE MOVEMENTS OF SCRAP BATTERY PARTS ON THE SOUTHERN PACIFIC RAILROAD (1976)

ORIGIN	DESTINATION	AMOUNT IN CARLOADS	TONS/CAR	AMOUNT IN TONS	REVENUE $000	REVENUE $/CWT	MILES
National Metals Tucson, Arizona	National Fibers Dallas, Texas	2	50	100	2.92	1.46	1400
National Metals Tucson, Arizona	Houston Lead Houston, Texas	1	50	50	1.57	1.57	1136
Arizona Recycling Phoenix, Arizona	Tuboscope Houston, Texas	1	50	50	.96	.96	1215

TABLE E-3

SAMPLE MOVEMENTS OF SPENT SULFURIC ACID ON THE MISSOURI PACIFIC RAILROAD (1976)

ORIGIN	DESTINATION	NO. OF CARS	TONS/CAR	NO. OF TONS	X-336 RATE	MILES
Baytown, Taxas	Channelview, Texas	121	91	10,964	.23 cwt.-R.35	15.6
Channelview, Texas	Baytown, Texas	100	86	8,617	.23 cwt.-R.35	15.6
Channelview, Texas	Strang, Texas	132	85	11,156	.31 cwt.-R.35	38.6
Freeport, Texas	Houston, Texas	113	77	8,661	.37 cwt.-R.35	66.6

TABLE E-3

RATES FOR MOVEMENT OF HAZARDOUS WASTES BY RAIL

RR	CARLOADS	TONS/CAR	$/CWT	MILES	CAR LEASE COST (a)	TOTAL $/CWT	
						LEASED CAR(a)	OWNED CAR(b)
Spent Sulfuric Acid							
SP	120	75	0.99	787	0.08	1.07	0.92
	89	46	.38	135	.02	.40	.36
	224	51	.13	26	.004	.13	.13
	15	85	.76	823	.08	.84	.70
	498	66	.21	65	.01	.22	.20
MoPac	121	91	.23	16	.001	.23	.23
	100	86	.23	16	.001	.23	.23
	132	85	.31	39	.003	.31	.31
	113	77	.37	67	.007	.38	.36
Scrap Battery Parts							
SP	2	50	1.46	1400	-	-	-
	1	50	1.57	1136	-	-	-
	1	50	.96	1215	-	-	-

NOTE: Average carload = 69.5 tons

(a) At 16¢ per loaded car mile, net of mileage payment
(b) At 13¢ per loaded car mile, net of mileage payment

APPENDIX F

FLOW OF FUNDS MODEL

1. Flow of Funds Model

ADL has developed a model of the financial operations of a company or investment project incorporating:

- Taxation
- Depreciation
- Short- and long-term financing
- Flow of funds.

The model can be used, for example, for forecasting the performance of a company over a planning horizon, for pricing decisions, or for determining the profitability of an investment. The essence of the model is the cash flow equations, which are summarized in this Appendix.

The basic equation underlying the analysis of capital requirements is the cashflow model:

$$GCF_t = \overline{P_t Q_t} - \overline{COE}_t - TAX_t + ITC_t - INV_t - INT_t \tag{1}$$

$$NCF_t = GCF_t + D_t - DA_t \tag{2}$$

where

GCF_t = Gross cashflow in period t

NCF_t = Net cashflow (cashflow to equity in period t)

INT_t = Interest paid in period t

P_t = Product price in period t

Q_t = Product sales volume in physical units in period t

COE_t = Cash operating expense in period t (exclusive of interest and taxes)

D_t = Total new debt raised in period t

DA_t = Debt repaid in period t

TAX_t = Federal income tax payable in period t

ITC_t = Investment tax credit in period t

INV_r = Investments in period t

The gross cashflow is defined as the total amount of cash arising from operations (if positive) or the total amount of cash required for operations (if negative) excluding debt repayment or debt raised. Note that for a single project, the gross cashflow stream (when working capital is included with investment) reflects the profitability of the project. When debt raised and payed is added to the gross cashflow, the net cashflow is derived. The net cashflow is the total cash arising out of or required for operations. The net cashflow can also be defined as the difference between sources and uses. Due to the balancing of sources and uses, the excess goes into dividends working capital and marketable securities. If negative, it is balanced by new equity. Formally,

$$NCF_t = DIV_t + \Delta WC_t + \Delta MS_t - E_t \tag{3}$$

where

ΔWC_t = Net increase in working capital in period t = $WC_t - WC_{t-1}$

WC_t = Working capital in period t

ΔMS_t = Increase in marketable securities in period t = $MS_t - MS_{t-1}$

MS_t = Marketable securities in period t

E_t = New equity raised in period t

There are two distinct types of analyses performed with the model:

- Project Analysis
- Company Analysis

A project analysis is primarily used to evaluate a new investment or an existing operation based upon the cash flow generated by that investment/operation alone, without regard to the capital structure of the corporation of parent company. A company analysis is used to examine performance (historic or forecast).

The project analysis treats working capital as part of investment (i.e., ΔWC_t is added to INV_t and otherwise ignored, and hence change in working capital appears in gross cashflow. In addition, short-term borrowing to cover cash shortages is not allowed, and liquid assets, dividends, etc., are not involved in the analysis. For a company analysis, short-term needs (e.g., minimum working capital) are satisfied first from marketable securities and income, and then if necessary from short-term borrowed. Formally:

$$SD_t = \text{Max}\ (0, - MS_{t-1} + \Delta WC_t - GCF_t + DA_t - LD_t - E_t)$$

where

SD_t = Short-term debt raised in period t

LD_t = Long-term debt raised in period t

The external financing requirement is the difference between the required outlays of funds and the funds available from operations or from the liquidation of uncommitted cash assets. The distribution of capital between equity and long-term debt is controlled with parameters input into the model. The remainder of external financing comes from short-term analyses. For project analyses, external financing is usually all "equity," i.e., the amount of financing required from the corporate entity or parent to support the project. Debt can be used if one wishes to generate interest expense automatically.

Dividends are expressed as a percentage of profits except that they are limited by available funds before short-term borrowing. Thus,

$$DIV_t = \mathrm{Min}\,(\alpha_t\, NI_t,\ E_t + LD_t - DA_t + GCF_t - \Delta WC_t + MS_{t-1})$$

where

α = Pre-specified dividend percentage for period t

NI_t = Net income in period t

$= P_tQ_t - COE_t - DEP_t - TAX_t + ITC_t$

DEP_t = Depreciation in period t

Federal income tax is

$$TAX_t = \tau(P_tQ_t - COE_t - DEP_t - INT_t - TXCF_t)$$

where

τ = Federal income tax rate

$TXCF_t$ = Tax loss carryforward utilized in period t

and the investment tax credit ITC_t is limited by TAX_t.

The working capital equation is

$$WC_t = OCB_t + INVENT_t + REC_t - PAY_t$$

where

OCB_t = Operating cash balance held in period t

$INVENT_t$ = Inventories held in period t

REC_t = Accounts receivable held in period t

PAY_t = Accounts payable accrued through period t.

OCB_t and PAY_t are assumed to be proportional to operating loss while $INVENT_t$ and REC_t are assumed to be proportional to sales.

2. Pricing Applications

The project application of the model allows revenue or price to be set to attain a specified internal rate of return. In the hazardous waste industry analyses, a ten percent after tax internal rate of return was targeted on new investments and the marginal revenues (change in price) necessary to obtain the rate of return was then determined.

3. Parameters and Assumptions

(1) Working Capital Factors

The parameters used to determine working capital factors were based on the report "Potential for Capacity Creation in the Hazardous Waste Management Industry." These factors were

- Operating cash balance = 13 days cash operating costs (excluding interest and taxes),
- Receivables = 16 days sales, and
- Inventories = 16 days sales.
- Accounts payable = 18 days cash operating cost.

(2) Debt Assumptions

Short-term interest was assumed to be 12% and long-term interest was assumed to be 10%. The debt repayment schedule was at an equal level with a 10-year period. The percentage borrowed was assumed to be 60%, which is consistent with the long-term debt to equity ratio indicated in the above referenced report.

(3) Depreciation

The new investment was depreciated over facility life (ten years). Both straight-line and double-declining balance depreciation options are available. However, the straight-line method was used in this analysis.

APPENDIX G

REFERENCES

APPENDIX G

REFERENCES

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PERSONAL COMMUNICATION SOURCES

17. Boston Steel and Manufacturing Company, Malden, Massachusetts

18. By-Products Management, Inc., Schererville, Indiana

19. International Harvester, Medford, Massachusetts

20. Keefe Trucking Company, Portsmouth, New Hampshire

21. Matlack, Inc., Lansdowne, Pennsylvania

22. National Tank Truck Carriers, Inc.
American Trucking Associations, Inc., Washington, D.C.

23. Pollution Control, El Dorado, Arkansas

24. Research Information Office
Office of Hazardous Material Operations
Department of Transportation
Washington, D.C.

25. Tech-Weld Corporation, Burlington, Massachusetts

26. Truck Trailer Manufacturer's Association, Arlington, Virginia

27. Barge Company

28. Tank Car Division, GATX, Chicago, Illinois

29. Southern Pacific Railroad

30. Missouri Pacific Railroad

31. Chesapeake-Baltimore and Ohio Railroad

32. Foster D. Snell, Inc.
Division of Booz, Allen and Hamilton, Inc.
Florham Park, New Jersey

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APPENDIX H

GLOSSARY OF TERMS

APPENDIX H

GLOSSARY OF TERMS

BILL OF LADING -- An itemized list of goods contained in a shipment.

COMMODITY -- Any article of commerce. Goods shipped.

COMMODITY, EXEMPT -- Goods that may be transported in interstate commerce without operating authority or published rates.

COMMON CARRIER -- A transportation business that offers service to the general public. Interstate common carriers must hold a franchise issued by the Interstate Commerce Commission which limits service to a specific geographical area.

COMPETITIVE RATE -- A charge established to meet the competition of another transportation line.

CONTRACT CARRIER -- A company that engages in for-hire transportation of property under individual contract or agreement with one or a limited number of shippers.

DUMP BODY -- Truck body of any type which can be tilted to discharge its load.

EXEMPT CARRIER -- Trucks hauling certain commodities are exempt from Interstate Commerce Commission economic regulation. The largest portion of the exempt carriers transport agricultural commodities or seafood.

FLATBED -- Truck or trailer without sides and top.

FORK LIFT -- A machine used to move goods loaded on pallets or skids.

FREIGHT BILL -- Document for a common carrier shipment. Gives description of the freight, its weight, amount of charges, taxes and whether collet or prepaid. Charges paid in advance are called prepaid freight bills. Charges collected at destination are called destination or collect freight bills.

FREIGHT FORWARDER -- A company that assembles small shipments, from various shippers, into larger shipments to form a full truck or car load. Forwarders send the consolidated freight to a station where it is disassembled and routed to the proper destinations.

GYPSY -- An independent truck operator who drives his own truck and secures freight wherever he can, or one who trip-leases to authorized carriers.

HOPPER BODY -- Truck body capable of discharging its load through a bottom opening without tilting.

INSULATED BODY -- Truck or trailer designed for transportation of commodities at controlled temperatures. It may be equipped for refrigeration or heating.

INTERSTATE COMMERCE ACT -- An act of Congress regulating the practices, rates, and rules of transportation lines engaged in handling interstate traffic.

INTERSTATE COMMERCE COMMISSION (ICC) -- The federal body charged with enforcing Acts of Congress affecting interstate commerce.

INTRASTATE TRAFFIC -- Traffic having origin, destination, and entire transportation within the same state.

POINT OF ORIGIN -- The terminal at which freight is received from the shipper.

PRIVATE CARRIER -- A company which maintains its own trucks to transport its own freight.

PROOF OF DELIVERY -- Delivery receipt copy of freight bill signed by receiver at time of delivery.

RATE -- The charge for transporting freight.

REGULAR COMMON CARRIER -- Any company authorized to serve the public and to transport general commodities over set routes.

RESTRICTED ARTICLES -- Commodities that can be handled only under certain specific conditions.

SHIPPING ORDER -- Instructions to carrier for transportation of a shipment, usually a copy of the bill of lading.

STAKE BODY -- Truck or trailer platform body with readily removable stakes, which may be joined by chains, slats, or panels.

STRAIGHT TRUCK -- A truck with the body and engine mounted on the same chassis (as contrasted to a combination unit such as a tractor semitrailer).

TANK TRUCK CARRIER -- Any for-hire carrier that serves the general public and is authorized to carry petroleum, chemical liquid, or dry commodities in bulk, by means of specialized tank truck units.

TANK TRAILER -- Enclosed truck trailer designed solely for the transportation of fluid commodities in bulk.

TANKER -- Truck, semitrailer, or trailer with a tank body for hauling liquids.

TRANSPORT -- To move freight from one place to another.

WAYBILL -- Description of goods sent with a common carrier freight shipment.

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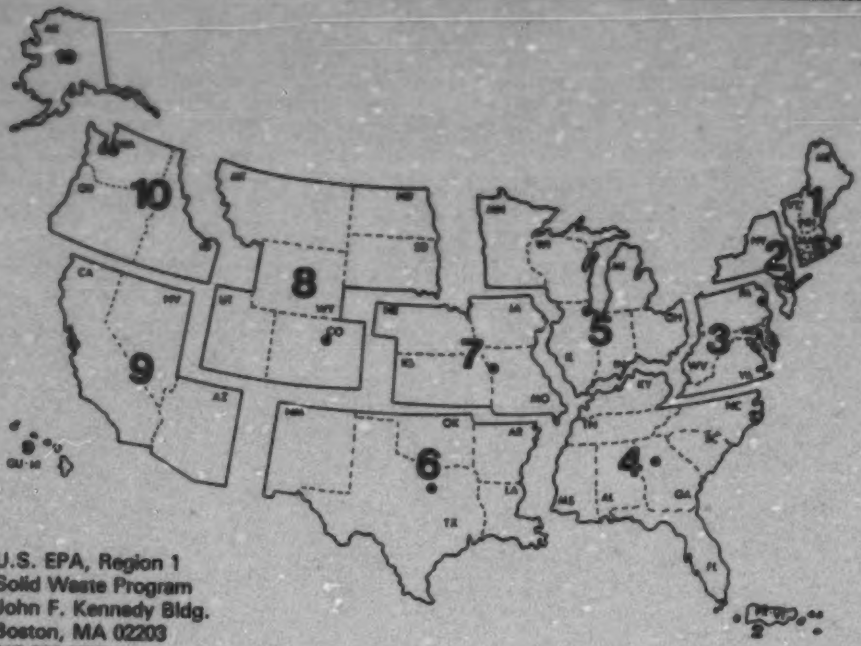

U.S. EPA, Region 1
Solid Waste Program
John F. Kennedy Bldg.
Boston, MA 02203
617-223-5775

U.S. EPA, Region 2
Solid Waste Section
26 Federal Plaza
New York, NY 10007
212-264-0503

U.S. EPA, Region 3
Solid Waste Program
6th and Walnut Sts.
Philadelphia, PA 19106
215-597-9377

U.S. EPA, Region 4
Solid Waste Program
345 Courtland St., N.E.
Altanta, GA 30308
404-881-3016

U.S. EPA, Region 5
Solid Waste Program
230 South Dearborn St.
Chicago, IL 60604
312-353-2197

U.S. EPA, Region 6
Solid Waste Section
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Dallas, TX 75270
214-767-2734

U.S. EPA, Region 7
Solid Waste Section
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Kansas City, MO 64108
816-374-3307

U.S. EPA, Region 8
Solid Waste Section
1860 Lincoln St.
Denver, CO 80295
303-837-2221

U.S. EPA, Region 9
Solid Waste Program
215 Fremont St.
San Francisco, CA 94105
415-556-4606

U.S. EPA, Region 10
Solid Waste Program
1200 6th Ave.
Seattle, WA 98101
206-442-1260